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# NEWS

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**This month's cover by Tony Palladino abstracts the concept of the use of curtain wall components and panel construction in contemporary architecture.**

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# forecast

## DEVELOPMENTS IN CURTAIN WALL SEALANTS

*One of the ways the Building Research Institute pursues its aim to focus attention of the construction industry on building research and technology is through forums. A/E NEWS presents a review of talks delivered at the recent BRI session on Sealants for Curtain Walls, 8th Annual Meeting, Building Research Institute, Pittsburgh, Pa., April 7 and 8, 1959.*

**New developments in polysulfide building sealers** *by George J. Schulte, Product Manager, Adhesives, Coatings & Sealers Division, Minnesota Mining & Manufacturing Co.*

". . . Let's go back to be sure that we understand what a polysulfide or *Thiokol* is. *Thiokol* by itself refers only to Thiokol Corp. which manufactures a wide variety of products including *Thiokol* liquid polymer. This is a syrupy liquid which can be mixed with a chemical to produce a solid chunk of cured rubber called a polysulfide.

"The sealer manufacturer must add certain ingredients to the liquid polymer to produce a suitable building sealer. To obtain adhesion to various surfaces, resins are added either in liquid or solid form. To impart color, body and strength, pigments such as aluminum, dioxide and carbon black may be used. Many other chemical materials are also used to give flexibility and durability. These are carefully mixed in powerful mixing equipment, to make the "base compound." On the job the curing agent is mixed in to cause the sealer to slowly cure to solid rubber.

"There are commercially available two very different polysulfides. One is the two part just described. The other is a one part mastic type that never hardens or cures. This is used for sealing metal-to-metal joints in buildings where there is little movement. This sealer which comes in bulk or ribbon form is useful only where very little elasticity is required.

"The two part sealer is of greatest interest so let's review its latest developments. First, the two part polysulfides are available in a variety of colors. This doesn't mean that they come in all shades of the rainbow as do oil paints. It means that the industry's basic color need can now be met with such colors as: aluminum, gray, tan, black, off white, gold, yellow and brown. Other colors are possible, but remember that a new color is only as good as the amount of research put into it to assure a stable color and a durable sealer. A large volume potential must be shown before most manufacturers will produce a special color. Please try to use standard colors where possible and you will receive the best quality products and the speediest service.

"A question is frequently asked, "Is aluminum sealer as good as black?" Of course, the different manufacturers' products vary somewhat but generally it may be said that a highly metallic aluminum color reduces the strength of the sealant. In most cases this is not significant and aluminum is suited for virtually all applications. Only in the most extreme cases of movement would it be necessary to consider black. As for the other colors, gray and tan generally have properties very nearly as good as those of black. The properties of the other colors must be judged individually. However, they can usually be made to perform as well as aluminum.

"Another important property that is essential in a polysulfide is adhesion to surfaces. The sealant must stick as it is applied in the liquid condition and after it cures to the solid rubbery sealant. One of the most difficult surfaces to stick to is glass.

"In curtain wall work polysulfides are used for glazing the large lights of glass and for sealing opaque glass panels. Wind bends the glass and deflection of 1¾" has been measured at the center of a large light 8′ x 11′ x ½" thick. This exerts a peeling or shearing action on the sealant. Polysulfides properly formulated have excellent adhesion to glass under all ordinary weather conditions. If polysulfides are not properly formulated, ultraviolet rays from the sun can cause some loss of adhesion after passing through the glass. I do not know of any field failures from this source, but the laboratory tests point out this possibility. So, be sure that you use a sealant that is made to have good adhesion to glass. Reputable sealant manufacturers should be able to furnish test data confirming this.

"One of the most questionable surfaces for polysulfides to bond to is lacquered aluminum. In bonding to lacquer you depend upon its adhesion to the metal. Various attempts have been made to produce polysulfides which would eat through the lacquer giving adhesion to the anodized aluminum or plain aluminum surfaces beneath it. Since the thickness of the lacquer coat varies considerably, this is a difficult way in which to solve this problem. Most manufacturers of sealants today recommend removal of the lacquer. This is difficult even with the best solvents. A more positive approach is to prevent the lacquer from being applied to the surface in the first place. This may be done by applying a high temperature masking tape to the edges of the metal that is to be lacquered. After lacquering, the heat resistant masking tape is removed and the bare aluminum surface is exposed for sealing.

"The third surface that requires special treatment is masonry. Most manufacturers of sealants recommend that a primer be used on most masonry surfaces. These include brick, concrete, limestone and marble. The primer is applied in a thin film which soaks into the concrete forming a solid relatively waterproof surface. The sealant (which is thick and which does not wet into the pores of the bare masonry surface) sticks very well to the primer.

"Another property of great interest today is the non-staining quality of certain polysulfide sealants. We all know that there have been a few marble buildings around the country that have shown a pink stain after a polysulfide was applied. Research work done by our company as well as other suppliers of sealants, Thiokol Corp. and various independent organizations, indicate that this is a rather complex reaction between certain types of resins which may be added to polysulfides and certain impurities such as iron salts present in the marble or mortar. The important thing to note here is that certain manufacturers of sealers have been able to produce polysulfides which do not contain these resins that give this stain. Some of these sealers have been on buildings long enough to know that a stain is very unlikely to occur. So the answer to this problem is to consult reliable sealant manufacturers for their recommendations.

"We are also frequently asked, "How long will a polysulfide sealer last?" Just as man's life span is increasing, so is the life span of polysulfides. Thiokol Corp. has been able to improve the properties of the Thiokol liquid polymer and sealant manufacturers have been able to add resins and reinforcing agents which improve the flexibility and durability of the sealants. A correlation has been developed between the flexibility and hardness of sealants that have weathered on buildings for ten years and laboratory accelerated weathering tests. These indicate quite conclusively that present day polysulfides properly compounded should remain flexible and durable for many years under the most severe conditions. It is difficult to place an exact number of years on this life because many factors affect the life—such as the climate, design of the seam, etc.

"So much for the properties of the newer products. Let us discuss briefly some of the new design ideas which are so important in making two part polysulfides work properly. Today, there are two basic designs in use for sealing windows or curtain wall panels.

"One is the use of polysulfides to seal the surface seam on the outside of the window or panel. Spacer blocks are used to hold the proper spacing between the panels or glass and the frame of the building. The cavity beneath the polysulfide is filled with a non-hardening non-oily resilient rubber ribbon or mastic ribbon. This lowers the cost per foot and assures a satisfactory backing for the sealant. This method allows inspection of the seam and also permits the manufacturer to determine if sufficient sealer was used. The second sealing method is that of sealing beneath the glass or panel in the channel. Here the polysulfide is applied before any oil base caulking compounds may be used. This eliminates the possibility of contamination of the surface. Spacer blocks are required or a rubber ribbon may be used as a spacer and secondary seal above the polysulfide sealer. The principle limitation of this method is the difficulty of inspecting the seal between the panel and the frame of the building. This method may give lower costs because of the elimination of outside scaffolding since all sealing may be done from the inside.

"It is very important to remember that sufficient space must be allowed for the sealant to do the job intended. In most cases the minimum width of a joint should be at least ⅛" and the depth should be ¼". Metal-to-metal expansion joints in building frames may require considerably larger quantities of sealant. Most manufacturers recommend that their sealant be used in designs where it is not stretched more than 50 per cent. That is, the sealer is not to be pulled more than ½ of its original dimension in any direction. . . .

"Now a word about application methods. I feel that it is necessary to discuss this even though some of it may be "old stuff." Many architects and users do not yet understand that polysulfide sealants are not difficult to mix and to apply. They also do not understand that the surfaces do not need to be microscopically clean to do a good job. Most applicators who have used these sealants say that they are easy to use when they are applied properly. In order to do this the surfaces should be wiped down with a solvent as suggested by the manufacturer of the sealant as reported previously in this discussion. Some surfaces require a primer which is easy to apply with a paint brush. As for mixing, any of the polysulfides may be mixed by hand with a large spatula. It is essential, however, that they be thoroughly mixed to obtain a proper cure. Caulking guns may be filled directly from the mixing container simply by placing the barrel of the gun beneath the surface of the sealant and pulling back slowly on the plunger. Most applicators find the sealant very easy to flow into place and of course, there

(*Continued on page 41*)

# gazette

Michel Feuche, space and research analyst, to technical staff of the *Building Research Institute* as assistant to Harold Horowitz, Assistant Director for Technical Programs. *BRI* is a unit of the *Division of Engineering and Industrial Research, National Academy of Sciences-National Research Council.*

Dr. Nicholas A. Weil, named Director of Mechanical Engineering Research at *Armour Research Foundation* of Illinois Institute of Technology, Chicago.

Mrs. Eva Zeisel, Associate Professor in Industrial Design, and Marc S. Harrison, Instructor in Industrial Design, appointed as new members to the faculty of the Rhode Island School of Design in Providence, R. I.

The following were elected national officers for the *American Society for Testing Materials:* F. L. LaQue, President; Miles N. Clair, Vice-President; A. Allan Bates, Senior Vice-President. A. B. Cornthwaite, C. L. Kent, H. C. Miller, C. F. Nixon, H. D. Wilde and I. V. Williams were elected to three year terms on the Board of Directors; Robert Thompson was elected to a two year term.

Richard W. Norman, AIA, and Fred Rudat, AIA, of the Oregon Chapter AIA were responsible for the exhibition "A Century of Oregon Architecture," at the Oregon Centennial exposition in Portland. Mrs. Van Evera of the Women's Architectural League, and Marion Ross of the University of Oregon, a member of the AIA's *Committee on Preservation of Historic Buildings*, prepared the accompanying brochure.

Lewis J. Woodruff, AIA, and Jack Knostman, AIA, of the Houston Chapter AIA, named to the Mayor's Advisory Committee to assist in preparation of new building code for the city of Houston.

Arthur F. Schwarz, AIA, of the St. Louis Chapter AIA, reappointed to St. Louis Plan Commission for four year term.

John C. Narber, PE, appointed Director of Planning by Charles Luckman Associates, planning-architecture-engineering firm of Los Angeles and New York.

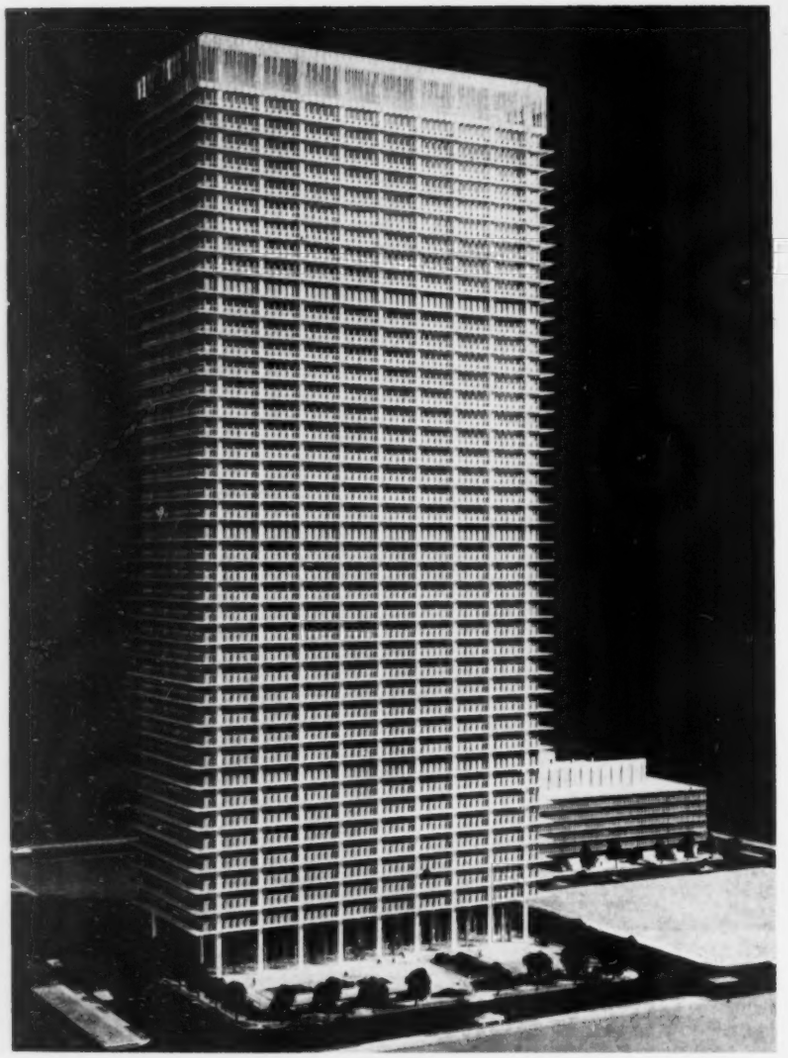
Richard E. Barnes named Technical Director of the *Perlite Institute.* He will assist member companies with technical problems.

John V. Sheoris, AIA, James E. Gibson, AIA, and Robert C. Cunov, PE, appointed as Chief Designer, Project Administrator and Chief Structural Engineer, respectively, at Harley, Ellington and Day, Inc., Detroit architects and engineers.

**Office announcements**

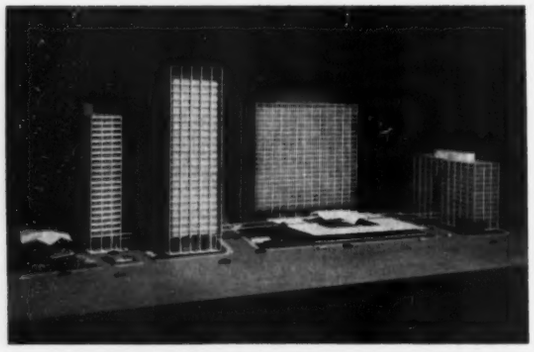
Francis E. Honey, Consulting Engineer, to 417 S. W. Washington St., Portland 4, Ore.

Joseph G. Hoffmann, Architect, to 3101 Brown Road, at Tudor Ave., St. Louis 14, Mo.



New $32 million, 44-story Humble Oil and Refining Co. home office. Architects: Welton Becket and Associates; Assoc. Architects: Goleman & Rolfe and George Pierce and Abel Pierce. (Photo of model by Herbert Bruce Cross.) See West Coast Report.

# ae news

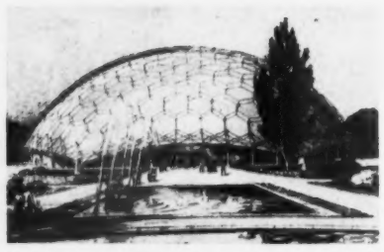


$30 million "city-within-city" development for Los Angeles by Charles Luckman Associates. (Photo of model by Herbert Bruce Cross.) See West Coast Report.

New $3 million, City National Bank Building, Los Angeles, by Victor Gruen and Associates. (Photography by Gordon Sommers.) See West Coast Report below.

$15 million, 13-story Indiana State Office Building, Indianapolis, features stainless steel window system and 600,000 sq. ft. area. Architects: Graham, Anderson, Probst & White, Chicago, with Raymond S. Kastendieck, Gary, Ind., as Associate Architect. (Rendering: Furno.)

Design has been approved for new $5 million, seven-story Federal Office Building for General Services Administration, to be erected in downtown Toledo. Architects and Engineers: Bellman Gillet & Richards, Toledo, Ohio.



Geodesic greenhouse in Shaw's Garden, St. Louis. Story below.

## Geodesic greenhouse

A giant geodesic dome, 175 feet in diameter at the base and a height of 70 feet, will house part of the famed "Shaw's Garden" in St. Louis, Mo. It will be the first greenhouse structure of its type. Architects Murphy and Mackey of St. Louis disclose that a novel climatic control system, by using an electronic panel, will be capable of producing rain, mist, arid air and almost any other kind of atmosphere demanded by the rare plants. The Columbus Division of North American Aviation, Inc., has been awarded the contract to build the geodesic structure.

## West coast report

The $3 million City National Bank Building, designed by the architectural, planning and engineering firm of *Victor Gruen and Associates* will provide the tallest and largest office building on Los Angeles' famed Sunset Boulevard. The concrete and steel structure will feature a seven-story tower rising from a two-story base highlighted with a 26-foot high glass-enclosed entrance lobby. More than 106,000 square feet of parking space will be provided for tenants and visitors. (See photo.)

*Kegley, Westphall, Arbogast and Stewart,* Los Angeles architectural firm has been named to design the structure for an 125-acre shopping center, *Holidayland,* according to James B. Stewart, AIA, vice-president of the firm. The new project will feature a "Mother Goose" theme surrounded by an atmosphere of fantasy. The Mother Goose theme will be expressed in the main shopping area by a gigantic aerial Mother Goose riding on her inflated goose, while characters

from Anderson Tales appear and "speak" from battlements in the castle walls to be built around the area, Stewart said. Among other features planned for Holidayland are a narrow-gauge railroad as well as Chinese junks cruising through winding waterways to carry visitors through the atmospheric parks of the project.

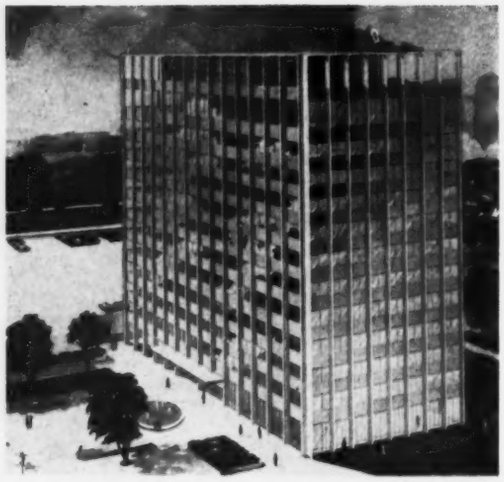
A "city-within-a-city" development planned for Los Angeles' Wilshire Boulevard at a cost of $30 million will be designed by *Charles Luckman Associates,* planning-architecture-engineering firm of Los Angeles and New York. The project will feature a 340-room hotel, office and residential structures and will provide a co-ordinated architectural ensemble. (See photo.) The Luckman office also has been retained to design a new $3.5 million hospital for Anchorage, Alaska. The four-story structure will provide 77,-416 square feet of space for a variety of medical facilities. (See photo.)

Construction has started on a new $3 million Nebraska Center for Continuing Education, according to Dr. Clifford M. Hardin, Chancellor of the University of Nebraska. The project designed by *Welton Becket and Associates,* architects and engineers of Los Angeles, in association with Selmer A. Solheim and Associates, architects and engineers of Lincoln, Neb. The Center will provide hotel accommodations, dining facilities, conference rooms and a two story auditorium seating 600. (See photo.) The Welton Becket office also designed the recently completed $3 million University Hall for the Berkeley campus of the University of California. The rectangular reinforced concrete structure provides a seven-story administrative center for the university. The Welton Becket office also has been retained to prepare final plans and specifications for the new $32 million, 44-story office building for the Humble Oil and Refining Company in Houston, Texas. Associated with the Becket organization are the Houston firms of Goleman & Rolfe and George Pierce and Abel Pierce, as consulting architects; Murray Erick and Associates of Los Angeles as structural engineers; and McClelland Engineers, Inc., of Houston. The building is planned as a simple rectangular tower, 225 feet long by 115 feet wide faces north toward downtown Houston. A landscaped plaza will provide a reflecting pool and fountains. The structure features a module or grid,

*(Continued on page 6)*

# ae news

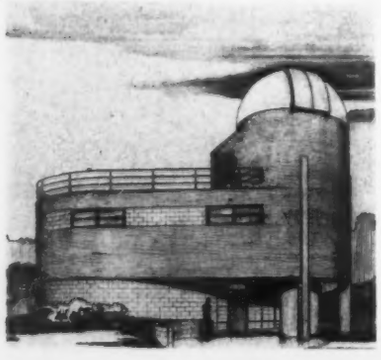
(*Continued from page 5*)



12-story office building, first unit of multi-million dollar development for 36th and Farnham Streets, Omaha, Nebr. Architects and Engineers: Henningson, Durham & Richardson, Omaha, Nebr.

$3.5 million, 4-story hospital for Anchorage, Alaska, scheduled for completion September, 1961. Architects: Charles Luckman Associates, Los Angeles.

Model of new $3 million Nebraska Center for Continuing Education at Lincoln, Nebr. Architects: Welton Becket and Associates with Selmer A. Solheim and Associates, Architects and Engineers of Lincoln.



The Stamford, Conn., Museum Astronomical Observatory will house a powerful 20 inch photo-visual telescope. The $150,000 project was designed by Gordon Edward Johnson, Architect, associated with Bertram Lee Whinston, AIA, Stamford, Conn.

Model of $7 million Southgate Towers Apartments, Miami Beach, Fla., shows bayside setting of South's largest apartment building. Completion scheduled for December, 1959. Architect: Melvin Grossman.

4'-8" square, designed to provide interior office space flexibility. Each module will be a self-contained unit with its own electrical and telephone connections with access to air conditioning. (See photo.)

## Competition/exhibits

An exhibition of three structures designed by Buckminster Fuller opened at the *Museum of Modern Art* New York. The purpose of the exhibition which features a space frame of anodized aluminum, a green plastic dome, and a black and white aluminum and monel mast, is to illustrate the extraordinary strength and lightness of Fuller's method of construction according to Arthur Drexel, Director of the Museum's Department of Architecture and Design.

The *Architectural League of New York* announces the 61st National Gold Medal Exhibition of the Building Arts to be held in collaboration with the *American Craftsmen's Council* from February 25 through May 15, 1960, in the *Museum of Contemporary Crafts* of New York.

The theme of this exhibition will be the progress that has been made, during the past five years, in the interrelated arts of architecture and interior design, engineering, murals, sculpture, landscape architecture, craftsmanship and industrial design. According to Morris Ketchum, Jr., FAIA, President of the League, this is "not just another architectural show—it is a broad and complete picture of the art and science of building."

The sixth annual *Architectural Awards Program* in Catholic institutional design has been announced. The 1960 program is under the jurisdiction of the Wisconsin Chapter of the AIA. Copies of the program and entry blanks may be secured from the *Sixth Annual Awards Program, Catholic Property Administration, 20 West Putnam Ave., Greenwich, Conn.*

## Education notes

A course in *Advanced Structures* for architects in practice is being offered by the *School of Architecture at Columbia University.* New concepts of design with an introduction to advanced structural theory in thin shells, membranes, space frames, lightweight metal and suspension structures, folded plates and prestressed concrete are offered. Those interested in the course are advised to write to Jan Hird Pokorny, AIA, Associate Professor of Architecture at Columbia University, New York 27, N. Y.

Columbia University has also broken ground for a new high-energy research building at the Univerity's Nevis Cyclotron Laboratory. The $430,000 structure will expand the facilities of Columbia's Physics Department for academic instruction and research in high energy nuclear physics. Architects for the project are Ferrenz and Taylor of New York.

## Science and research notes

Funds for the performance of research and development in private industrial firms totaled $7.2 billion in 1959, the *National Science Foundation* announced this month. Of this amount, slightly more than one-half was accounted for by two industries: aircraft and parts and electrical equipment.

A preliminary report entitled, "Funds for Research and Development Performance in American Industry, 1957," *Review of Data on Research & Development*, Number 14, describes a survey conducted for the Foundation by the Bureau of the Census, U.S. Department of Commerce.

Total performance of research and development in private industrial firms, as reported in the survey, increased about one-fifth between the two years covered, 1956 and 1957, from $6 billion to $7.2 billion.

Corrosion Research at the *National Bureau of Standards* has been designed to provide science and industry with solutions to some of the practical engineering problems encountered today, by an investigation into the primary processes of corrosion. Large single metal crystals are employed in some of the research to correlate corrosion with the arrangement of atoms in the crystal lattice. The role played by electrical phenomena and cathodic protection comprise a phase of the program. One study deals with the nature and mechanism of formation of oxide films on metal surfaces. The effect of illumination on the corrosion reaction has also been studied. By attacking the problem from different directions, the Bureau's corrosion research staff hopes to improve present methods for combating corrosion.

## AIA portfolio

Active architects of the New York Metropolitan area who have advanced

professional backgrounds have been urged to apply for one of the nation's top architectural awards, the *Arnold W. Brunner* scholarship, which has been increased for 1960 from $2,600 to $3,000. Candidates may choose their field of special study. Application blanks and further information may be obtained from Gillet Lefferts, Jr., Secretary of the New York Chapter of the AIA, 115 East 40th St., New York 16, N. Y. November 15, 1959 is the deadline for submission of choice of subject and an outline of proposed studies, research and travel.

The *American Institute of Architects* has announced regulations for the Fourth Annual $25,000 R. S. Reynolds Memorial Award for significant use of aluminum in architecture. Under the regulations, an architect may be nominated for the award by anyone—including himself or his firm. Nominations will be accepted until December 7, 1959. Architects practicing in any nation are eligible. Membership in a professional society is not required. Nomination forms can be obtained from the AIA, 1735 New York Ave., N.W., Washington, D. C.

### CEC/ASCE/NCSBEE news

The 38th annual meeting of the *National Council of State Boards of Engineering Examiners (NCSBEE)* was held recently in Roanoke, Va. The meeting was attended by over 300 official delegates and guests from the U.S. and Canada. President William H. Larkin of New York City presided over the discussions and actions of the meeting which gave considerable attention to the progress report of the Special Committee on Model Law Revision.

The Consulting Engineers Council, California Council of Civil Engineers, and Land Surveyors and the California Society of Professional Engineers were approved as "Participating Organizations" of the NCSBEE.

A recent meeting between *Consulting Engineers Council* President Ralph M. Westcott and recently-appointed Secretary of Commerce, Frederick H. Mueller, has resulted in a more positive policy in the use of private consulting engineers on Federal Highway

(*Continued on page 11*)

## METAL CURTAIN WALL PROBLEMS

*by FRANCIS L. FRYBERGH of Skidmore, Owings & Merrill, architects-engineers, who has studied chemical and industrial engineering at the University of Prague where he received his M.S. and Ph.D. He joined SOM in 1951 and at present is in charge of specifications in the New York office. He is a member of the Construction Specification Institute and a member of the newly formed Committee C-24 on Elastomeric Sealants of the American Society for Testing Materials.*

In discussing some of the problems with metal curtain walls which are still with us today, it seems appropriate to describe briefly the great advances that have been made to date in metal curtain wall construction.

Many metal curtain wall problems which existed only a few years ago have been eliminated or solved due mostly to the cooperation of architects, fabricators and erectors. Each has learned from experience that metal curtain wall construction requires the highest degree of teamwork from the very beginning if it is to be successful.

The trend toward the use of shopbuilt components which require only minor assembly operations in the field has minimized errors which were more numerous in an all-field assembled wall.

Erectors have become more familiar with sealants and are more experienced in their proper use and method of application.

Conscientious sealant manufacturers recognize the need for adequate technical assistance at the job site so as to prevent the improper use of their materials.

The erection of mock-ups of the proposed metal curtain wall, particularly for multi-story structures, gives the architect, fabricator and erector the opportunity to observe if the methods of assembly, erection and glazing are economical and will provide a trouble free installation. A mock-up also gives the owner an opportunity to get a better than "model-view" of the structure.

Dynamic or static pressure differential tests on metal curtain wall units enable the architect to study the behavior of the wall when subjected to wind loads or to a high pressure differential, and to make minor design changes or to adopt new sealing methods should failures occur during such tests.

Up to now each specification writer had to create his own standards, depending on his experience with metal curtain walls. Thanks to the efforts of the Building Research Institute which has highlighted curtain wall problems, the National Association of Architectural Metal Manufacturers, making full use of the organizational talents of Wayne Koppes, has issued a manual for curtain walls which is a major attempt at standardization in this complex field, and should be a veritable boon to writers who have to "tackle" their first curtain wall specification.

The producers of polysulfide base sealants have submitted a tentative specification to the American Standards Association. The American Society for Testing Materials has recognized the need of standardizing elastomeric sealants and has created Committee C-24 (of which the author has the honor of being a member) and which has tentatively been named "Sealants for Joints."

Some of the problems with metal curtain walls which still require clarification and further study are: the matching of scratch brushed, polished and caustic etched finishes on aluminum; the protection of ornamental metal surfaces during construction; the need for a sealant requiring less care in its application; and standardization of testing methods.

## Aluminum finishes

The perfect matching of aluminum finishes is still a problem today. For example, it has been customary to specify a one-hour anodized protection for exterior surfaces which is eight to nine tenths of a mil in thickness. For interior surfaces a protection of four to five tenths of a mil of oxide coatings is recommended. This general rule does not seem adequate where a perfect matching of finishes is required. Unclad aluminum alloys will, for example, show a marked difference even with a caustic etch finish. By rigidly adhering to the above anodizing thicknesses, the architect may find that metals that are supposedly capable of a complete match show differences in color. One metal section may appear darker than the other. This leads one to believe that *variation* in the *lengths* of anodizing may be necessary to obtain the desired effect.

Leading aluminum fabricators and erectors have been helpful and have assisted the architect in the proper selection of alloys for a given use. But it seems that the anodizer too, may have to be consulted early in order to insure that the selected alloys will, after finishing and anodizing, be perfectly uniform in appearance. Great success has been achieved in the matching of stainless steel, bronze and porcelain enameled aluminum finishes.

Metal curtain wall caulking requires perfectly clean metal and glass surfaces for best results. Lacquer (or any other protective coating) will interfere with the proper bond of the sealant because lacquer is not a permanent coating and sealants adhering to lacquer will perform only as long as the lacquer bonds to metal or glass. If a polysulfide base sealant, for example, is applied to perfectly clean materials, we may safely assume that the joint will be weathertight for a period of from 15 to 20 years.

## Protection of metals

An immediate follow-up to the question of matching of finishes is that of the protection of exposed ornamental metal surfaces against construction soiling, such as spillage of concrete, plaster or paint. This has consistently been a problem in the past and is still with us for the following reasons:

In order to enable the architect to observe whether a perfect match has been achieved in the specified finishes, the protection material should be clear. It must withstand weathering for at least two years, be immune to construction soil, be easily stripable or removable for caulking operations and shall not deface or mar the metal finishes, either by itself or due to the solvents needed for its removal.

The use of a water-white methacrylate lacquer protective coating has been common practice. In reading manufacturers' literature, one is led to believe that an ordinary solvent is all that is necessary for its removal, only to discover, often too late, that removal of this type of protection requires paint and varnish remover and lots of "elbow-grease." Obviously this can be a very costly and a time consuming operation on multi-story structures.

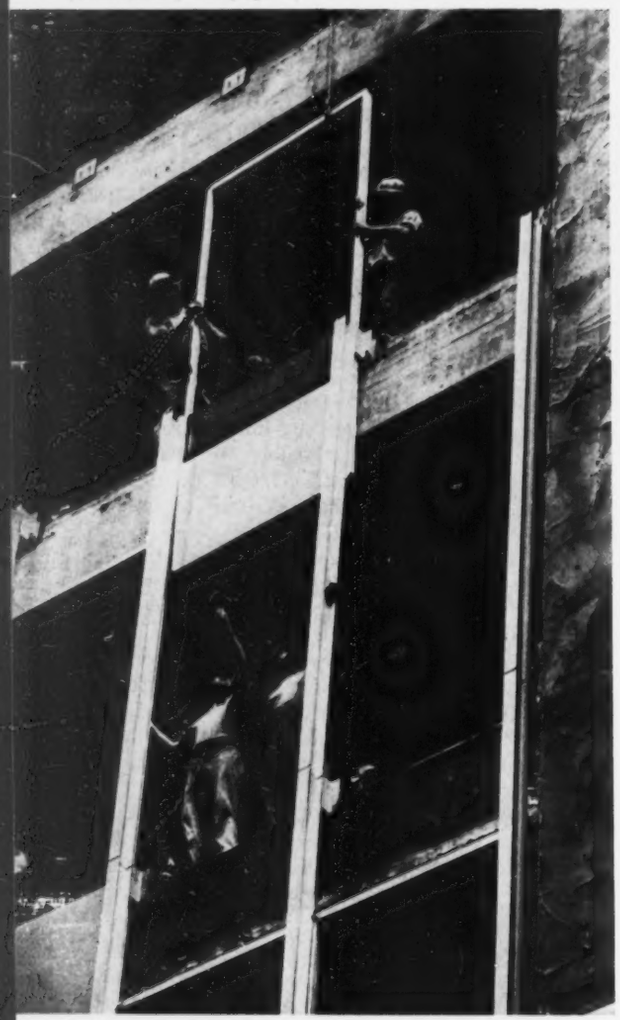
In addition, if the coating is left in place and is not maintained, part of the coating will dissipate by itself, while other portions of the building will still be protected and after a period of time, the metal surfaces may present a spotty appearance.

*(Continued on page 10)*

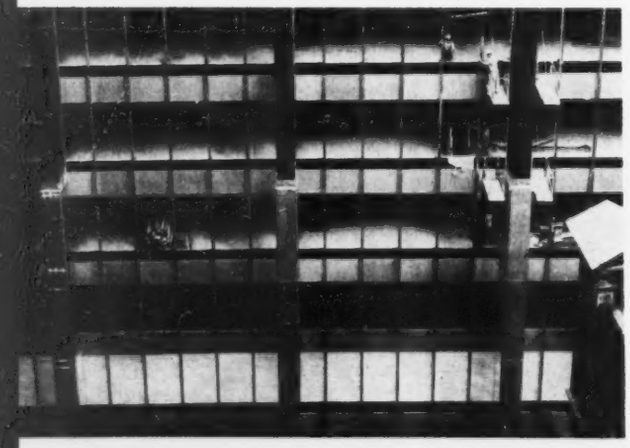
Opposite page: 60-story aluminum and glass Chase Manhattan Bank Building is New York's 6th largest skyscraper, and represents largest metal curtain wall contract ever let. At left: Matching of metal facias invariably a critical problem. Building shown is Connecticut General Life Insurance Company's home office building. Architects for both structures: Skidmore, Owings and Merrill. Connecticut General Terrace designed by sculptor Isamu Noguchi. (Photograph by Ezra Stoller.)

## METAL CURTAIN WALL PROBLEMS

(*Continued from page 9*)



Some of the 9,600 aluminum wall panels (above) for the new Chase Manhattan Bank Building are set into place between vertical mullions. Building will utilize 1,750 tons of aluminum. When completed, more than 800,000 sq. ft. of wall area will be enclosed by the panels. Workmen are preparing (below) to position metal covering around exterior column. To eliminate problem of noise whistling throughout the columns, stainless steel flashing was installed around each column on every fourth floor.



The need for a protective, ornamental metal coating or film that is clear, easy to remove and non-staining is great and it is encouraging to know that the paint and plastics industry is hard at work to provide us with a protection material that fulfills the above requirements.

### Caulking

The ability of a sealant to achieve the same result of perfection in the field as is obtainable under laboratory, and therefore, highly controlled conditions, is another problem.

This question is a critical one particularly for skyscrapers, where proper, architectural supervision of each joint is impossible. We have to rely, to a great degree, on the supervision of the contractor himself, and on the personnel of the compound manufacturer, to assist the contractor for best results.

It would be very desirable indeed if a sealant could be perfected which did *not* require this utmost degree of perfection in application, where setting time and surface cleanliness are secondary considerations, and which could be applied on a surface that is slightly moist and is not "perfectly" clean.

### Need for training

It has been advocated that training schools for "specialty caulkers" be created in order to improve the workmanship. Many erectors, to their advantage, are employing such specialists and have greatly eased the fear of failures in metal curtain wall construction. In the past, it has been customary to give a metal worker, a glazier or a mason a caulking gun and instruct him to "caulk the joint." However, many workmen are not familiar with the intricacies of the new sealant material.

### Testing

The architect is faced with difficult problems in deciding when to require testing of curtain wall sections and what methods are to be used. It should, for example, not be necessary to require testing of standard curtain walls. The manufacturers of prefabricated standard curtain walls could, as was done by the window manufacturers, perform tests on their wall sections. As part of their specifications, they could certify that if all the curtain wall components, including sealants, furnished by them are installed in strict accordance with their requirements, the completed curtain wall would be guaranteed to withstand a given wind load and be free of any water infiltration.

Custom curtain walls pose different problems. In multi-story structures particularly, failures in sealants or sealing methods which become apparent during tests, allow for minor changes prior to the beginning of erection at the site without any addition in costs. Corrections after erection, on the other hand, may be very costly if one considers the inaccessibility of sealants and gaskets in the completed wall. It is therefore essential that, once it is decided to perform tests on curtain wall sections, all materials and methods used in the erection of test panels be identical to the materials proposed for the final curtain wall. The erection of test panels and subsequent tests give the curtain wall erector, the glazing contractor and the architect the opportunity to evaluate the specified materials and methods of sealing. It is naturally important to consider the geographical location of the building before a particular test method is selected. The dynamic test or the static pressure differential test are most often used. The static pressure differential test combined with a temperature differential test, whereby the interior surface of the wall section is kept at temperatures of 70 to 80 degrees F. and the outside temperature is varied from 150 degrees F. to minus 10 degrees F., is considered by many to be the severest test to which curtain wall sections can be subjected. After 20 days of continuous cycling, many sealants which we were accustomed to accept as satisfactory have failed.

The defenders of the dynamic test maintain that their method simulates best actual weather conditions, with gusts of high wind causing sudden stresses in the skin, opposed to the constant deflection obtained with the static pressure differential test. The supporters of the static pressure differential test, combined with a temperature test on the other hand, state that the dynamic test is valid for a set of given conditions at the time of testing only, and that their method simulates best actual weather conditions. It would be a great contribution to curtain wall construction if we could standardize test methods for each geographical location and avoid all the arguments and often heated discussions that now complicate our approach to this problem. In this connection, it is interesting to note that the testing laboratories have not provided us with proper test facilities near our large construction centers, and it is often necessary to go on "testing expeditions." It should not be necessary for architects, erection crews, glaziers and various observers to travel to distant test centers, causing time losses and increases in costs, only because not enough curtain wall test facilities are available.

A great contribution could also be made by the manufacturers of sealants and extruded tapes. These materials may withstand the severest laboratory tests and be apparently perfectly serviceable under a wide temperature range. But laboratory tests, only too often, do not simulate actual field use. For example, some sealants and mastic compounds with a temperature range of plus 200 to minus 40 degrees F. slump badly in actual use, after only 10 cycles of the combination static pressure and temperature differential test and therefore, have no sealing value.

Metal curtain wall construction is not the product of one group alone, and all of us, the architect, and now also the testing laboratory, have an equal share in its success or failure.

## ae news

(*Continued from page 7*)

and public road projects. The CEC also announces its semi-annual Board of Directors meeting in Cincinnati, Ohio on November 5-7, 1959.

"Mid-Century Construction—What's Right? Wrong? New?" is the theme of a forthcoming Regional Conference on Construction to be held in Kansas City, Mo., under the sponsorship of the KC Section of the *American Society of Civil Engineers*. Outstanding speakers in the construction fields will be presented at the technical sessions to be held November 12 and 13. Advance registration may be made through Willis G. Fish, Kansas City District, Corps of Engineers, Federal Building, Kansas City, Mo.

### BRAB and BRI notes

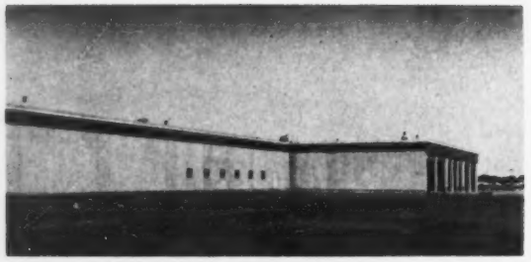
A report on Protection from Moisture for Slab-on-Ground Construction and for Habitable Space below Grade has been completed by the *Building Research Advisory Board (BRAB)* and is available through the National Academy of Sciences—National Research Council. The report considers the fundamentals of moisture behavior in soils, insulation, concrete and flooring. It also draws attention to the sources of moisture, especially the seepage of surface water through foundation walls. Copies may be purchased (NAS-NRC Publication #707, @ $1.50) from the Printing and Publication Office of the National Academy of Sciences—National Research Council, 2101 Constitution Ave., Washington 25, D.C.

With some 50 speakers, 80 to 90 workshop participants and more than 30 panel discussion members, the *Building Research Institute (BRI)* will stage on November 17-19 the largest multi-subject conference in its history at the Shoreham Hotel, Washington, D.C. The three days of the conference will be devoted to sandwich panel design, new heating methods, modular design and construction, metal curtain walls and with means of coping with the deluge of building science research literature. Registration and information on the full program may be obtained from Milton C. Coon, Jr., Executive Director, BRI, 2101 Constitution Ave., Washington 25, D.C.

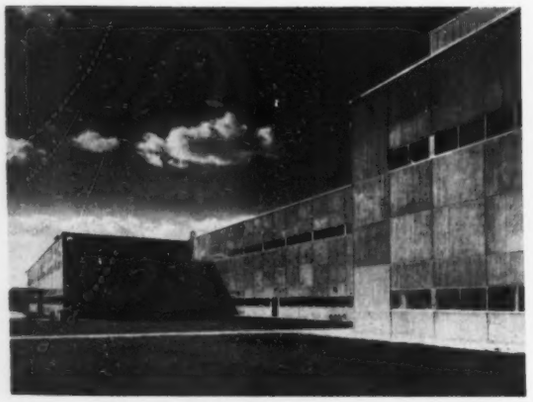
## PRECAST SANDWICH PANELS

*by Philip M. Grennan, PE**

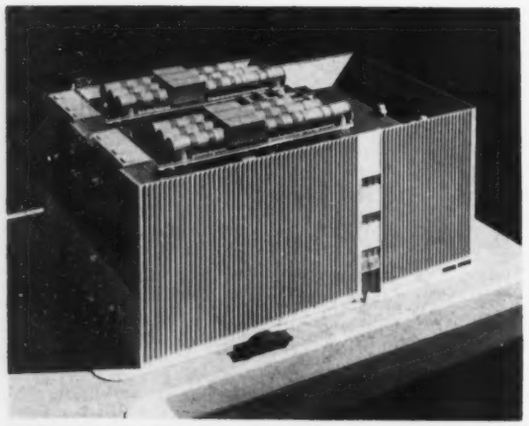
*A pioneer in the design and development of the precast sandwich panel who was responsible for the first project of this type in the United States, discusses this dynamic innovation in curtain wall systems. Sandwich panel design criteria will be the subject of a paper to be given by Mr. Grennan at a forthcoming conference and workshop program of the Building Research Institute, November 17, 1959, at Washington, D. C.*



McGraw-Hill Building at Heights Town, N. J., provides book distribution center, utilizing 16'-9" high by 6' wide precast sandwich panels. Exterior facing has fluted finish created by use of deeply corrugated steel form. (Photo: Gottscho-Schleisner, Inc.)



Grumman Aircraft Engineering Corporation at Calverton, Long Island. Aircraft assembly blanket area of 179,000 sq. ft., enclosed by precast sandwich panels. (Photo: Gottscho-Schleisner, Inc.)



Model of the Public Service of New Jersey, Newark Switching Station. Structure used 61' high by 4' wide precast sandwich panels. Each panel weighed 10 tons. In all 187 panels were used for this project. (Photo: Gottscho-Schleisner, Inc.)

### Original design criteria

Almost ten years ago, research was begun for construction of a power plant for the Electro Metallurgical Division of the Union Carbide and Carbon Corporation at Marietta, Ohio.

At that time, the client requested that a suitable substitute be found for a 12-inch brick wall. When design studies were made for Electromet's new power plant, masonry walls were considered too costly ($3.50 for a 12-inch brick wall.) The consulting engineers retained by the company were asked to proceed with a detailed research for an appropriate substitute.

The research took many forms in which cost comparisons, factors of weather protection, insulating value, appearance, panel size, production, erection and maintenance were all investigated and carefully evaluated. Ultimately the research conducted by the consulting engineers gave rise to the development of large precast concrete sandwich panel walls into which a core of insulating material consisting of chemically treated wood chips combined with a cement binder were incorporated between two thin layers of precast concrete.

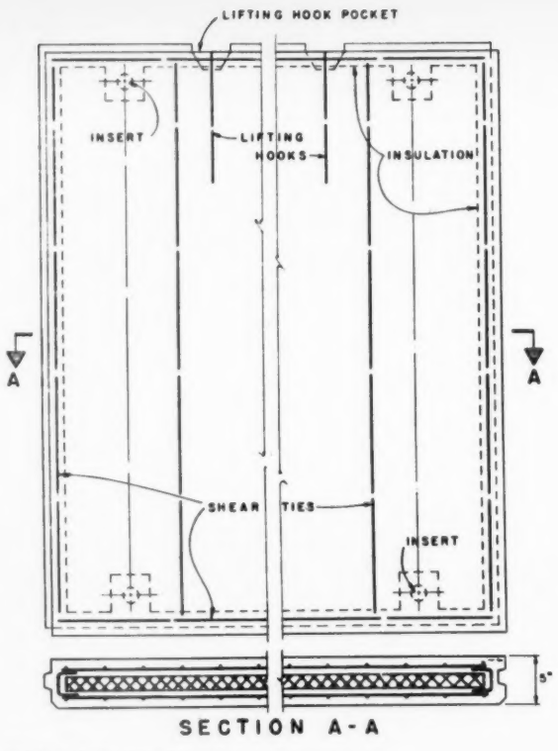
Over 80,000 square feet of five-inch thick panels were utilized for the wall enclosure of the Marietta project which covered an area of approximately 600,000 square feet.

### Details of panel design

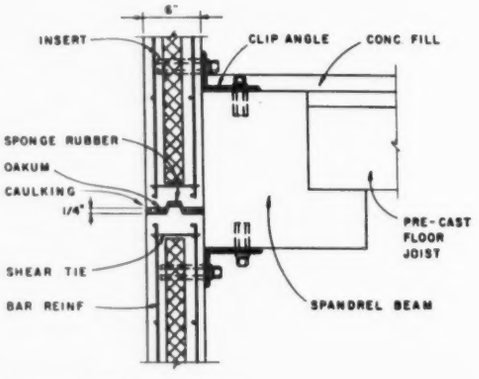
Details are stated below about the Marietta power plant panels. Since these were our prototype panels, these details have general application to all precast sandwich panels.

1. *Structural design:* the structural design of the panels was dictated by, among other factors, the method of handling and placing of the panels. In order to utilize the formwork most effectively, the panels had to be removed from horizontal forms 20 hours after the concrete had been placed. In removing the panels from their forms, they are subjected to greater stresses than when

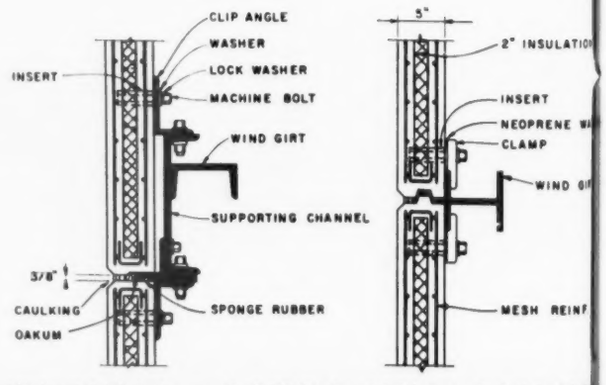
* *Mr. Grennan is a Professional Engineer and an Associate in the Office of Alfred Easton Poor, Architects, New York City. He is an author and lecturer on precast and prestressed construction, in addition to his having won a significant award for structural design in this area of engineering.*




Typical wall panel elevation and section above.




Horizontal joint at spandrel.




Horizontal joint at support. (left) Horizontal joint at wind girt. (righ

in position where they are not subjected to the same stress conditions and where the concrete reaches its ultimate stress as it curves in its installed position. By casting the panel with its exterior face down, the curing of the concrete is improved because the panel remains damp and it is not disturbed.

An air-entraining agent was added to the high-early strength concrete mix which must have a strength of 4000 psi in 28 days. Reinforcement was provided in each concrete layer with a 4x4-inch #10 wire mesh. Tips of chairs were especially treated at contact points to protect the finish face of the panel. To provide ease of handling and erection, two U-bars were embedded at the top edge of each panel. Two threaded metal sleeves designed to receive connection bolts were also embedded at the top and bottom edges of each panel. Each face of the panel is reinforced both for negative and positive pressures which range from 20 lbs per square foot to 75 pounds per square foot. Shear ties were designed for diagonal tension and longitudinal shear.

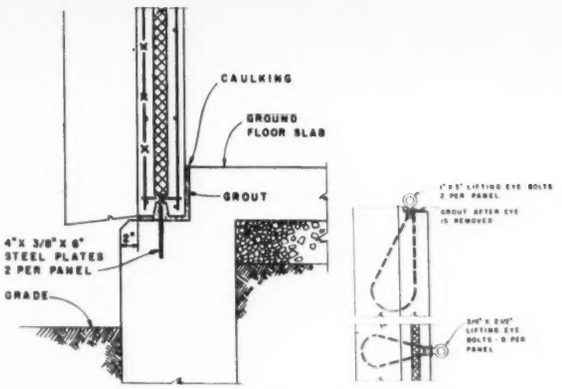
Strips of expanded metal, bent to form 2½" deep channels tied the concrete layers. They also functioned as spacers for the sheets of the core insulation.

Connection of the panels was provided by a system of clip angles and malleable iron clamps. Metal sleeves or inserts received ¾" machine bolts which provided adjustable and positive structural fasteners. The panels were supported on the steel frames of the Marietta project buildings at every third course. Wind loads are taken by steel girts at each horizontal joint level.

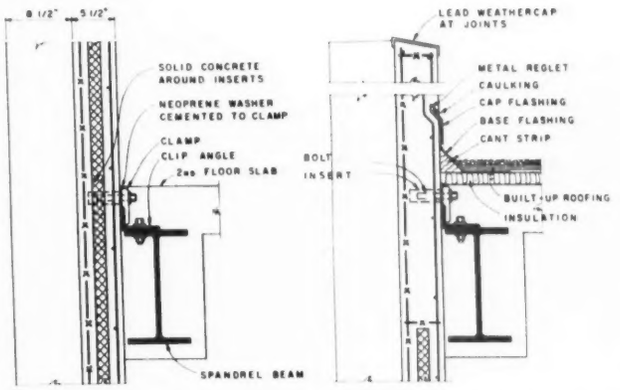
2. *Minimum thickness* was usually controlled by the joint detail. Maximum thickness is usually set by either the insulating core or the dictates of structural design. In the Marietta panels, the design of the tongue and groove joints established the 5-inch thickness of the panels.

3. *Insulation:* various materials were considered for their insulation value. Comparative studies were made of cost, supply, handling, fabrication, water absorption rates, thermal transfer, sizes, weight and uniformity in thickness. Effective insulators have proven to be precast concrete slabs made with an aggregate of wood chips, cellular glass insulation block, fibrous glass reinforced panels, and expanded polystyrene. A "U-factor" of .14 was achieved in the Marietta panels.

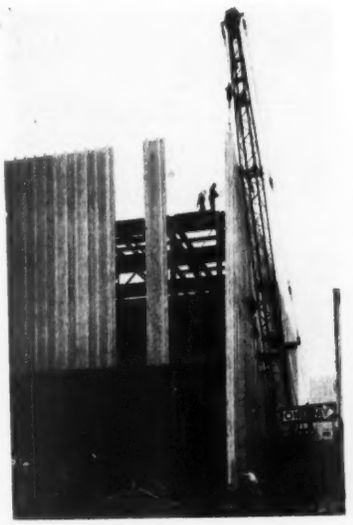
4. *Joint details:* the edges of panels were formed for either tongue and groove or spline joints. Tongue and groove joints serve as excellent water barriers. In addition they provide a means of aligning the panel on the steel framework. Prior to installation, a continuous impervious cellular rubber strip was cemented in the grooves with a rubber adhesive. After the panels were in place, the joints were packed with oakum and then caulked. However, where one panel bore directly on one below, no oakum was used in horizontal joints. Cement mortar was used instead. The exterior joint was raked ¾" and then caulked to match the other joints.



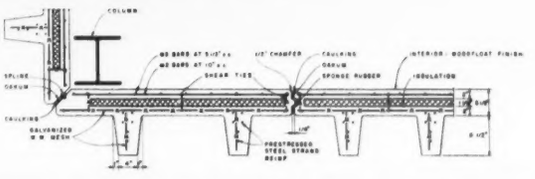

Vertical section at base. (left) Panel lifting eye inserts. (right)




Vertical section at second floor. (left) Vertical section at parapet. (right)



Newark Switching Station details above and below. Photo (left) shows erection of 61' high precast concrete panels. Erection crane had only 12' wide alley of work space.




Horizontal section of precast panel with reinforced fins, showing spline corner assembly.

5. *Surface finishes:* exterior finishes may be broomed, trowelled, formed or form liner, and of exposed aggregate. Interior finishes may be muslin form liner, wood float or steel trowel. In the pioneer Marietta panels, the inner face had a smooth texture which was non-reflective and capable of receiving paint easily. This surface was produced by lining the steel form with muslin. When the fabric was stripped from the hardened concrete, it left a woven texture. The exterior face of the Marietta panel was provided with a wood float and rattan broom finish. This treatment produced a series of fine, vertical, random serrations or grooves.

## Various performance experiences

As stated earlier, the first building with this type of wall panel construction was erected at Marietta, Ohio at a cost of $2.00 per square foot in place. Since that time, the Union Carbide and Carbon Corporation has used some 600,000 square feet of the material in their Marietta plant and well over a million square feet in other plants which include those at Sault Ste. Marie, Mich., Niagara Falls, N. Y., and Ashtabula, Ohio.

In 1953, the Grumman Aircraft Engineering Corp. at Calverton, L. I., used 178,000 square feet for its assembly plant.

We have also used the same type of panel design for blast-resistant radio relay stations for A.T.&T. These structures are located from coast-to-coast and include earthquake areas.

The McGraw-Hill Book Distribution Center at Heightstown, N. J., an all precast and prestressed concrete building assembly of some 200,000 square feet in floor area, was enclosed with this type of panel. The panel length is 16'-9" from foundation wall to eave spandrel. The exterior finish was formed with a fluted steel sheet. The U-factor of the panel is 0.13. The spandrel beams were painted with an epoxy resin paint which our experience has proven to be very durable. The top of the structure is concrete in pre-cast section to permit its removal for future expansion and extension of the presently completed building. At the top of the panel, a seat is provided for future framing. The advantages in economy gained by this type of construction are excellent. There isn't a wall panel of the McGraw-Hill building which cannot be removed and reused. Considerable savings in any future expansion can be effected here. The use of a system of precast and prestressed concrete units produced speed in design and erection, interior flexibility with a minimum bay size of 25' x 31', future expandability and the utilization of a conveyor system to process an inventory of millions of books.

In the Public Service of New Jersey, Newark Switching Station, panels 61 feet tall, four feet wide and 5½ inches thick were used to enclose the structure. These prestressed sandwich panels utilized a 5000#/4" concrete. These panels were

*(Continued on page 14)*

## PRECAST SANDWICH PANELS

(*Continued from page 13*)

cast on a 320 foot prestressing bed. The units were pretensioned, after losses, to 744 psi according to our specification and used a ⅜" diameter prestressing strand. The slabs were reinforced with wire mesh and rods.

One of the design requirements was the provision that the upper 14 feet of the 61-foot panels be used as a parapet. Prestressing of the panels was accomplished on the neutral axis plus or minus.

The panels were erected with one crane under unusually cramped conditions. The crane had to be placed in a 12-foot wide alley. Eye bolts cast into the inside face and at the top edge of each panel were used for lifting and final placement.

### Regulatory experience

Wind loads of 30# per square foot are easily provided for on 20-foot spans. A 75# per square foot wind load is accommodated on 14-foot spans, 5½" thick. In the Public Service of New Jersey project, mentioned above, the 14-foot cantilever parapet section was designed to withstand wind stresses of 30# per square foot.

The panels are considered to have a two-hour fire rating without test, using a variety of insulation materials. By using specific insulation and 6-inch thickness, successful tests up to a 6-hour fire rating have been made.

### Modifications based on experience

Some modifications as a result of our experience are indicated for our design and specification criteria. In design, a spline joint is preferable to a tongue and groove joint in that an uninterrupted blanket insulation can be provided.

In the area of the specification of caulking compounds it has been our experience that polysulfide rubber base caulking is a decided improvement over the conventional caulking compounds. Another problem has been the maintenance of a uniform color in concrete. Some improvement has been noted when the panels are cast outside face down using form liners and avoiding differences in hand finishing. Further control of color should be written into the specifications by limiting the materials to one source, confining the mixing time to a precise period and controlling the curing in the early stages to a positive and uniform procedure.

### Future developments

Some of the future developments in concrete sandwich panel design will be in the provision of a greater variety of finishes such as colored concrete, exposed aggregate, more intricately textured forms and the use of "cast-on" facings such as stainless steel, ceramic tile and other materials. Further development of this type of wall construction will be enhanced by continually improving production methods and more use of prestressed units for longer spans.

*The use of sealed curtain wall construction in today's buildings is practical only if means are provided to reach and service the exterior. Powered maintenance platforms or "window washing machines" are necessary elements which have their interrelated effect on curtain wall system design. One such project was the Connecticut General Life Insurance Building by Skidmore, Owings and Merrill. Photograph by Ezra Stoller. Article by Walter Veit**

# BUILDING MAINTENANCE INTO CURTAIN WALLS

The growth in popularity of the modern curtain wall building with its sealed skin of metal and non-movable glass—for fixed sash—has sparked the development and use of a piece of equipment which the *Saturday Evening Post* recently called "the ultimate in king sized gadgets." This reference was to the unique, and still novel, powered maintenance platforms, or "window washing machines," which travel on their own private rail system about the face of some of the country's most distinguished buildings.

Lever House in New York City had the first of these machines, and it is still a highlight to visitors to Park Avenue's first glass building. In the seven years since this machine was evolved, several variants of design have come from the drawing boards of the engineers who pioneered this prototype. Unique in principle and design, is that provided for the new home offices of Connecticut General Life Insurance Co., near Hartford.

The building was the product of a team in which a Connecticut General Group headed by President Frazer Wilde, worked closely with the architects, Skidmore, Owings and Merrill, and Turner Construction Co., the builder. To this project, Skidmore, Owings and Merrill brought high design ability, a thorough awareness of modern building materials, and a record for achieving economy and low maintenance. All are reflected in the result—a building of low, simple, geometric mass, engineering simplicity and impressive use of glass and steel. Into this project they have tried to incorporate three major objectives: convenience, economy, and efficiency of operation and maintenance.

The achievement of efficiency of operation and maintenance was thus one of the three basic design fundamentals prescribed initially by the design team. Wilde wanted minimum maintenance costs. The company stated its willingness to make any reasonable initial investment in materials and equipment that offered to reduce the yearly costs of cleaning, painting, repair and replacement. The decision to employ sealed skin construction stems in part from this philosophy, and the details of design were arrived at after exhaustive study, not only of the specific materials to be employed, but also of such interrelated problems as heating, air-conditioning, lighting and exterior maintenance.

The magnitude of the operation may be gleaned from a few simple statistics. The Connecticut General buildings consist of a large three-story and basement building, 324 feet x 468 feet and 52 feet roof to ground, and a smaller four-story building containing executive offices, 72 feet x 216 feet, the two buildings connected by a passageway over 60 feet in length, three-stories high. The main building contains four interior courts, each 72 foot square, to provide additional light and airiness to the building. The entire structure is sheathed in aluminum, stainless steel and glass.

The assembly of this skin required considerable inventiveness. It represented one of the largest installations of glass in the country to date. There are 600 lights of $\frac{5}{8}$" heat-absorbent glass, each measuring 11'-2" x 8'-2". In addition, there are 2,500 smaller glass spandrels, $\frac{3}{8}$" thick, 68" x 34", and for the first floor of the main building, 200 lights of untinted $\frac{3}{8}$" plate glass. Great effects were taken to set the glass within $\frac{1}{16}$" of a true plane in order to achieve a perfect reflection of the countryside.

The aluminum, stainless steel and glass elements were prefabricated for assembly at the site. First alumilited aluminum wall sections were bolted onto steel frame members, then glass sheets were lifted and set in place by a special machine. Once the glass was set, strips of satin-finished stainless steel were added as trim. Cushions of neoprene tubing were placed between the glass and the aluminum frame. Then a polysulfide sealant was applied along the edge of each light of glass.

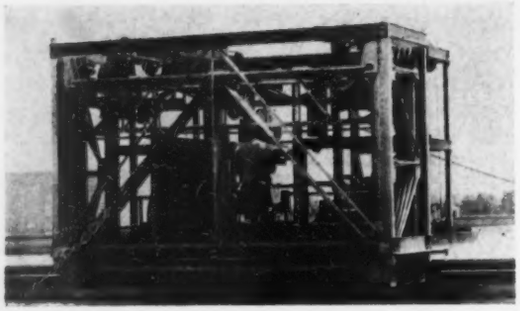
These walls were designed for durability. Their maintenance and upkeep was intended to be limited to periodic washing of both glass and aluminum, occasional recaulking of the seams and possible replacement of damaged glass. In order to do this, means had to be provided to reach all external wall areas, including courts and passageways, by means of a machine which would permit one or more men to work comfortably and efficiently. Armed with the experience of similar problems which they had faced and solved in the design of Lever House and the new Ford Central Staff Office Building, the architects called on their previous consultants, Manning & Lewis Engineering Co.

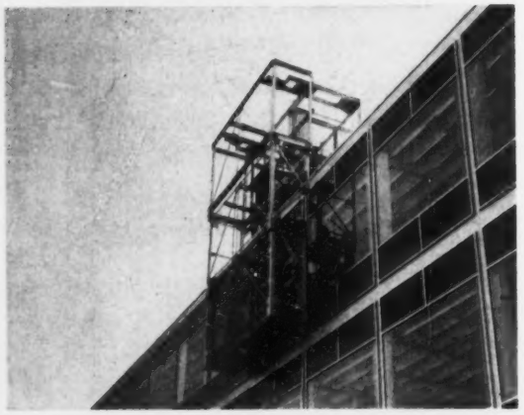
The very nature of this building with its sealed construction, blind courts and special conformation called for window washing and wall maintenance provision of unusual design.

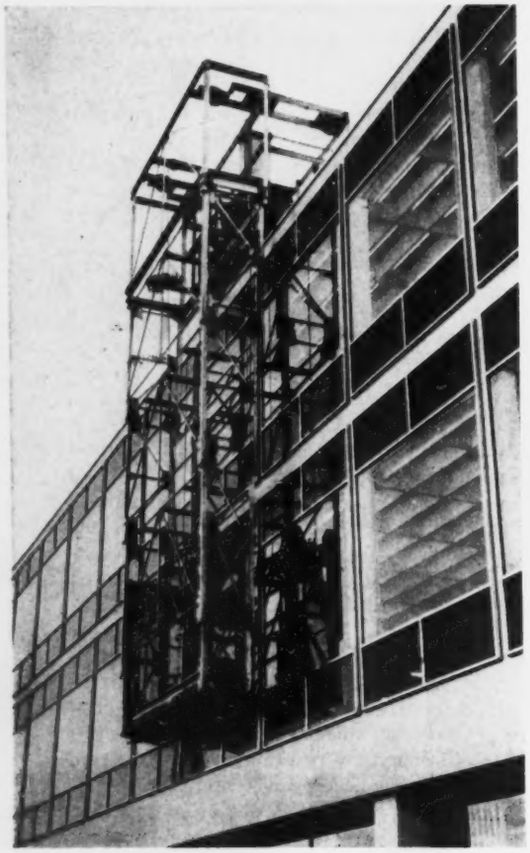
The requirements were greatly different from those faced in the Lever House and Ford buildings. There the problem was one of providing a device for vertical travel over the face of an intermediate skyscraper. In these types, the platform is keyed to tracks in the wall of the build-

*(Continued on page 16)*

** Mr. Veit, a senior partner of Manning & Lewis Engineering Company of Newark, N. J., is an acknowledged pioneer of this type of equipment.*







Powered maintenance machine for Connecticut General project is shown in three operating positions. Top: telescoped entirely at parapet. Center: partially extended. Bottom: almost fully extended.

## BUILDING MAINTENANCE

*(Continued from page 15)*

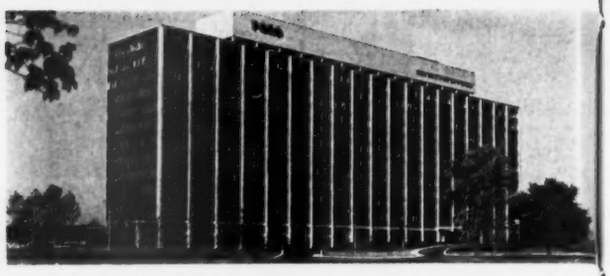
ing, and must be raised to roof level before it can traverse horizontally. At Connecticut General the problem was one of obtaining substantial horizontal travel and relatively little vertical travel, a fundamental difference which completely changed the concept of the machine.

Because of the difference in height between the north wing executive office building and the main building, two separate machines were called for: a main machine to handle the entire three-story structure and connecting passageway, and a smaller and lighter machine to clean and service the relatively small area of the four-story north wing. Early consideration was given to transferring a machine between buildings, but this was abandoned as impractical.

Consideration was given to handling this problem from the ground upward, by the use of a telescoping platform to run around the building either on wheels or on tracks laid in concrete walkways. This solution was ruled out for two reasons. The ground level varies too greatly around the building, and there are various interruptions to straight line travel, such as building approach ramps and canopies at entrances. Even more important, to have constructed the necessary walkways and trackage would have been architecturally incompatible with building and grounds designed for country living. The decision in this respect, therefore, was to retain the concept of roof mounted machines.

Previous machines had employed T-rail tracks, indented mullions, or the equivalent, to form a series of vertical guides in the building wall to serve as guideways for the operators' platform during vertical motion. It was the use of these guideways which dictated the necessity for having the platform returned to the roof level before shifting horizontally. Such continuous guides were, in the case of Connecticut General, impractical architecturally and would not lend themselves to operation in a predominantly horizontal direction of travel. There thus evolved the concept for the main machine of a platform which would be completely free of the building wall and which could travel horizontally or vertically at will, being stabilized against sway by the use of a system of interlocking telescopic frames which would form a rigid internal guidance system tying the platform, in effect, directly to the roof car.

The initial studies indicated that the use of a shorter operating platform than had been standard heretofore, would be more flexible in operation and probably more practical to construct, considering the decision to use the stabilizing frames. To use such a machine would require very short radius turns for the track system, this figure actually being finalized at a mere 4 feet. From these considerations it was decided that it would be possible with this track system, and using highly special articulated wheel sup-



SOM's Central Staff Office Building for the Ford Motor Company also uses platform which is lowered down face of building on vertical guide.

ports for the roof car, to develop a single machine with working platform necessarily of modest proportions, to service all of the areas of the main building, including the interior courts and connecting passageway.

This then, in turn, introduced the problem of transferring the machine from the outside walls to the four courts. It was decided that by devising a system of transfer tracks from the main trackage, the machine could be moved bodily on built-in transfer cars from the outside wall to the four courts.

Finally, the problem of providing over one-half mile of double trackage for the machine's travel required special solution in the engineering of adequate support and the development of a track interlock system. The end solution, a departure from previous practice, utilized long span I-beam track rather than industrial T-rails.

The Connecticut General main building machine finally developed is an electrically controlled platform suspended from a roof car which travels on tracks around the periphery of the building and its courts, the platform being completely stabilized by interlocking sections. The equipment consists of a roof car containing all operating mechanisms and a 15 foot operator platform suspended by cables from the roof car, with interlocking telescoping aluminum sections to restrain the platform against sway from any of the forces incident to normal operation and wind.

Spotted at intervals on the roof are 13 power and telephone outlets to which the roof car is connected by flexible cables with a maximum draw of 70 feet. Also at roof level is a special garage which houses the machine when it is not in use.

Inevitably, the questions arise: are these machines safe? What's to keep wind from swaying the platform, possibly turning it over. What keeps it from dropping too fast, out of control? Or one end suddenly lurching lower than the other, as frequently happens on painters' scaffolds? How do you prevent a thoughtless operator from traveling too fast, forgetting to raise his platform at critical points, or failing to follow certain essential prescribed steps.

To answer this—all operations of traverse, speed, elevation, descent and transfer are completely interlocked, both electrically and mechanically, by limit switches and mechanical interlocks, to protect against accidental malfunction and to enforce operation in the manner intended.

The machine was originally intended for two-man operation. At Connecticut General today, however, one operator, now thoroughly at home with his machine, makes the trip around the 2,670 lineal feet of building surface in 15 working days, cleaning an average of 5,800 square feet per day. In effect, it may be said that the architects have integrated continuing maintenance into the design of the building, and thus have succeeded in their purpose of passing on to Connecticut General all the advantages originally engineered into the materials of the building.

# METHODS OF TESTING CURTAIN WALLS

## STATIC LOAD TESTING

*Specifications for static load testing of metal curtain walls are provided in a tentative standard recommended by the Metal Curtain Wall Division, National Association of Architectural Metal Manufacturers.*

I. Scope

This specification defines the equipment and procedures to be used in employing static air pressure to test metal curtain walls and/or their components for:

| | |
|---|---|
| Air Infiltration | (Test A) |
| Water Leakage under Steady Temperature | (Test B) |
| Structural Performance under Steady Temperature | (Test C) |
| Air Infiltration, Water Leakage and Weathering under Cycled Temperature | (Test D) |

II. Test specimens

Wall specimens to be tested shall be of sufficient size to determine the performance of all typical parts of the wall system. The width shall be not less than that of one typical unit plus its connections and supporting elements at both sides; the height shall be not less than the full building story height and shall include the connections and supporting elements at top and bottom of the unit. Units designed to span two or more floors in height shall be tested in full height if possible, but if this is impractical, height runs may be reduced to the maximum that can be accommodated, provided that all joints and connections are included at full scale. Otherwise all parts of the wall test specimen shall be full size, and shall employ the same materials, details, methods of construction and anchorage as those to be used in the actual structure.

III. Test equipment

The equipment used shall be known as a Static Pressure Cell, and shall consist of three principal elements plus auxiliary apparatus and instrumentation, as illustrated in the accompanying drawings and described in the following:

A. A Pressure Chamber, fully insulated and airtight, and equipped with (1) controlled air supply, (2) water spray tubes with connected and controlled water supply, and (3) heating and cooling facilities as hereinafter described. The open edges of this Chamber shall be either gasketted (for movable Mounting Frame) or permanently sealed (for Pressure Chamber or Room Type Cell), to effect an airtight seal to the Mounting Frame (see item B following).

For Pressure Chamber and Room Type Cells having an integral Mounting Frame, the controlled air supply shall be capable of providing both positive and negative pressure within the chamber; for Cells having a removable Mounting Frame, either positive or negative pressure may be provided.

The water supply shall be capable of providing 2.5 gallons of water per hour for each square foot of the maximum test specimen area.

The heating facility within this chamber shall be such that it will produce a controlled surface temperature up to 160°F on black metal surfaces, in vertical and top-side horizontal positions, over the entire maximum test specimen area. The cooling facility shall be capable of reducing the air temperature within the chamber to 0°F.

B. A Mounting Frame, within which the wall test specimen is assembled, and to which it is anchored. This frame shall be of ample area to accommodate the required specimen size, with a completely airtight surround membrane filling the area between the specimen and the edges of the frame. The frame may be an integral part of item A, or a complete room divider in the case of a Room Type Static Pressure Cell.

C. An airtight Collection Chamber, having the same perimeter dimensions as the Pressure Chamber, with its open edges designed to be sealed airtight to that side of the Mounting Frame (or Pressure Chamber containing integral Mounting Frame) corresponding with the indoor side of the wall test specimen. This chamber shall have built into its wall a metering element to accurately determine gross air flow from chamber to atmosphere.

D. Apparatus for clamping together an airtight assembly, when using either (1) the three-element type cell or (2) the two-element type cell. The Room Type Cell does not require clamping apparatus.

E. Instrumentation to measure accurately the following:

1. Barometric pressure at the test station, in inches of mercury.
2. Air pressure differential and pressures in the chambers, in pounds per square foot and/or inches of water.
3. Gross air flow from the Collection Chamber, in cubic feet per minute.
4. Water flow into the Pressure Chamber, in gallons per minute.
5. Deflections in the components of the test specimen (under applied pressure), in inches.
6. Temperature in both chambers, in degrees Fahrenheit.
7. Surface temperatures at critical points on the outdoor face of the test specimen, in degrees Fahrenheit.

IV. Testing procedures

Procedures to be employed for the various tests shall be as specified in the following paragraphs. In all tests the data provided by measuring devices shall be properly recorded, along with pertinent observations, to be included in the test report.

A. Test to determine air infiltration. The wall test specimen shall be assembled in the Mounting Frame so that the exterior of the wall is facing the Pressure Chamber and the interior is contained by the Collection Chamber, forming an airtight cell. Instrumentation shall be provided as specified in III-E-1, 2 and 3.

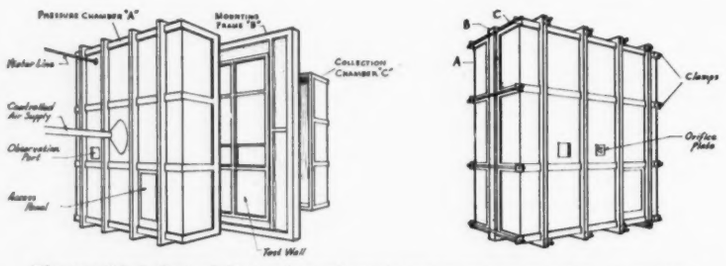
Air shall be introduced into the Pressure Chamber so that the pressure differential across the test specimen is 1.6 psf (equivalent to a 25 mph wind). This differential shall be maintained for not less than 15 minutes while the air infiltrating the test specimen is allowed to escape from the Collection Chamber to atmosphere, being measured as it passes through the metering element in the wall of that chamber.

The gross reading in cubic feet per minute shall be reduced to standard conditions of 29.92" Hg. and 68° F by the following formula:

$$\text{Correction Factor} = \frac{(68 + 460) \times \text{Station Barometric Pressure}}{29.92 \times (\text{Temp. of Flowing Air}) + 460)}$$

The net reading (Gross × C. F.) shall be further reduced to an air infiltration factor of cubic feet per minute per square foot of test specimen frontal area.

B. Test to determine water leakage under steady temperature. The wall test specimen shall be mounted with its exterior facing the Pressure




Disassembled view of three-element static pressure test cell with removable mounting frame shown left and assembled view of test cell shown at right. (Illus: NAAMM Curtain Wall Manual.)

Chamber in an airtight assembly. Instrumentation shall be provided as specified in III-E-2 and 4.

1. Standard procedure
   Water shall be applied through the spray tubes in the Pressure Chamber at the rate of 2.5 gallons per square foot of test specimen area per hour, completely covering the specimen, while a static pressure equal to one-fourth (¼) of the specified inward design load (for recommended design wind loads, see NAAMM Recommended Design Criteria, Part B.), but not less than 1.6 psf, is maintained in the chamber for a test period of not less than 30 minutes. Then the walls shall be allowed to drain and dry, with no water or static pressure applied, for a period of 60 minutes. All water leakage, if any, appearing on the indoor side of the specimen shall be collected and measured, and all points of leakage shall be recorded.
2. Special procedure
   When the building location warrants more severe testing than provided in the Standard Procedure, the following test shall be applied:
   Weep holes, if any, shall be sealed with caulking compound. Water shall be applied at the rate of 2.5 gallons per square foot of test specimen per hour, as in the Standard Procedure, and the pressure specified in the Standard Procedure shall be maintained for one minute. The pressure shall then be rapidly raised to the full specified inward design pressure, where it shall be held for 30 seconds, and then shall be reduced to the original pressure. This pressure cycle shall be accomplished within a period of 2 minutes. A total of three such cycles shall be run consecutively, maintaining as a minimum the pressure specified for the Standard Procedure. The location and amount of all leakage shall be noted.

C. Test to determine structural performance under steady temperature.
This test shall be conducted in two ways; (1) with pressure applied to the outdoor side of the wall test specimen, simulating positive wind pressure, and (2) with pressure applied to the indoor side, simulating negative pressure.
The instrumentation required shall be as specified in III-E-2 and 5 above.
In the test assembly for the positive

*(Continued on page 20)*

## METHODS OF TESTING

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pressure test, the outdoor side of the specimen shall face the Pressure Chamber. For the negative pressure test, using a three-element test cell, the indoor face of the specimen shall face the Pressure Chamber.

1. Positive Pressure test
   An initial pressure of one psf shall be applied on the exterior side of the wall specimen to take up slack. While this pressure is maintained, zero measurements shall be taken on the wall specimen at the points designated below:
   Ends and midspan of all framing members and rails of operable sash.
   Corners, midspan of edges, and midpoint of all glass and panel areas.
   Air pressure on the exterior side shall then be increased until the pressure differential across the wall is equal to the full specified inward design wind pressure, plus one psf, where it shall be maintained for not less than 15 minutes. During this period deflection measurements shall again be made at the above designated points.
   At the conclusion of this loading period the pressure shall be reduced to one psf and measurements shall again be taken at the designated points to determine what permanent set, if any, has occurred.
   For purposes of the test report, deflections under design load shall be reduced to the ratio of span as follows:

$$\text{Ratio} = \frac{\text{Midspan deflection—Average end deflection}}{\text{Span of member}}$$

2. Negative pressure test
   An initial pressure of one psf shall be applied on the interior side of the wall specimen to take up slack. While this pressure is maintained, zero measurements shall be taken on the wall specimen at the points designated in the positive pressure test.
   Air pressure on the interior side shall then be increased until the pressure differential across the wall is equal to the outward design wind pressure, plus one psf, where it shall be maintained for not less than 15 minutes.

On completion of each of these tests all parts of the wall and its anchorage shall be inspected for loosening of fasteners and seals, for distortion of members, or for any other evidence of structural or functional damage.

D. Test to determine air infiltration and water leakage under cycled temperature
   (To be issued later)

## DYNAMIC TESTING PROCEDURES

*Paper presented at the 8th annual meeting of the Building Research Institute by Walter J. Engert, Chief Designer, General Bronze Corporation, Garden City, New York.*

To aid the architect, contractor, engineer and owner in the preparation of rigid specifications, we are endeavoring to set forth the procedure and principles of weather testing architectural products, primarily applicable to windows and modern curtain wall construction. These tests provide static and dynamic conditions of air pressure, due to winds, in order to measure unit infiltration of air and water from wind driven rains.

In the interest of maintaining high standards and in a constant endeavor to improve products, all new designs should be subjected to these exhaustive weather tests. Products performance standards accepted throughout the industry are assured by these tests and will result in ultimate consumer satisfaction.

Although the practice of extremely exacting weather testing is a very recent development for the industry, static weather testing is already well standardized, though unrealistic. The newer and less well standardized method of dynamic weather testing is still in its infancy.

The need for more realistic methods of testing the facades of our relatively new technique of enclosing a modern building, first became evident in 1950. Since then, (probably a few years earlier), we have been using materials which do not absorb an ounce of water, like all masonry materials, produced by condensation of wind-driven rain. Our present materials are primarily metal and glass, with joints protected by synthetic compounds, ranging from gun-type elastomeric polysulfide polymers, to preformed or premolded-pressure gaskets.

These materials put all curtain wall manufacturers at the mercy of salesmen, selling their wares, some of whom have very little knowledge of the shortcomings of their own products. The proper section, the correct durometer and the manufacturing tolerances of these sealants are ethereal and most times indeterminable.

In any event, with any combinations of materials in use today, incapable of the slightest absorption of water, the slightest amount of water entering the building, thru the curtain wall, becomes a very serious consideration. One cup of water on the floor or ceiling of a building, during any given period of time, can seem to spread over a large area.

These characteristic phenomena of the materials now in use for building facades have forced the designing architect, the engineer and the metal manufacturer to intensive and extensive research of the materials being used.

The design of all joints, especially the expansion joints, is of prime importance. The choice of materials, most important of all, the sealants, become a very serious consideration.

How to evaluate the various components, how to know their performance by true and adequate testing procedures, and how to be assured the details will be satisfactory as part of our facade, becomes a controversial problem.

Almost all specifications dealing with "curtain wall" have required and still require a "static load test." As the title implies static-weathertesting covers the condition of a constant and a steady pressure applied to the surface by an artificial wind force. By this method it is assumed that pressure per unit area is uniformly distributed over the unit to be tested.

Water infiltration, in static weathertesting specifications, is generally not included due to the unavailability of suitable facilities for simulating natural conditions of wind and rainfall during these tests. Water infiltration specifications would seem to indicate that testing be done under dynamic test conditions.

The method of ascertaining "the static load," is by measuring devices and mathematics (using certain formulae) which are subject to variables and making the resulting data undependable.

Depending upon the formula employed, the results of the "static load test" can be as widespread as the formulae themselves. Both of the following formulae are acceptable, but which one is closer to the natural phenomenon:

The Marvin formula: $P = .004V^2$

The Emswiler formula: $P = .002496V^2$

Where P = the pressure and V = the velocity, as an example:

Wind velocity of 25 mph: The pressure, using the Marvin formula would be 2.500 psf. equal to .481 inches of water. Wind velocity of 25 mph: The pressure, using the Emswiler formula would be 1.560 psf equal to .300 inches of water. Who then, can determine accurately the method and the results of curtain wall performance, using the "static load test."

While information of the static load is important to the heating, ventilating and air conditioning engineers, it does not prove to be the actual phenomenon present over the facade of a building, during a wind and rain storm. It has been observed that in nature, other variables are present, such as changes of the wind intensity, low-pressure areas, and the location of the building in juxtaposition to other buildings.

Due to severe turbulence in the layer of air built-up close to the structure, dynamic pressures of gale and hurricane forces change rapidly in intensity and position. More or less steady wind pressures tend to produce vibratory stresses, while gusty gale winds are inclined to produce simply rapid changes in pressure.

The use of a 1200 horse power airplane engine, with a ten-foot propeller, placed about 20 feet from the face of the unit to be tested, has proven most satisfactory as an artificial wind generator.

The engine, idling at 800 rpm generates a flow of air having the velocity of about 40 mph using the Marvin formula. At 2500 rpm the wind velocity is approximately 105 mph. Comparing this to natural forces using the "Beaufort scale," we note that strong winds are 32 to 46 mph and gale winds are 47 to 63 mph—whole gale winds are 64 to 75 mph, and hurricane winds are all above 75 mph. The gust, or sudden violent, but brief blast of wind could be over 100 mph. The engine's rapid response to the throttle control, makes it especially suitable in duplicating the natural gusting of wind. In a period of less than ten seconds the wind velocity can be increased from 40 mph to 105 mph and returned to 40 mph. The severe turbulence created by this, produces stresses on the unit being tested, as on the building facade. The changes in wind intensity and the suction areas created on the mock-up can be measured. This is especially necessary when dealing with large glass areas.

Gauges placed at specific locations on the inside of the test panel indicate the deflection of critical members where excessive bending could cause damage to plaster and other non-load bearing materials in the building. Using electric instrumentation these deflections can be read from inside the control house.

The best argument for the dynamic test—using only the static test—it is possible to force water through any joint, unrealistically, with a sufficient pressure differential, while the dynamic test, being more realistic, comes closer to simulating nature.

Using the dynamic testing method, there is less danger of overdesigning the joints of a facade, which is costly, still being assured the installation will perform satisfactorily when subjected to the elements.

During the cycles of the static test, there is a great possibility that the sealing compound could be forced out of the joints, while under dynamic testing, more akin to nature, the selected compound would do its job.

It should be noted that in the glazing areas particularly, the method and type of materials to be used is of prime importance. If, for instance, pressure glazing with premolded, preformed, gaskets are to be used, the details must provide for definite compression of the gaskets. These details will also permit the more conventional glazing, using glazing compounds. But, if the details have been finalized for compound glazing, there is

no possibility of changing to the use of premolded pressure gaskets.

Again, the dynamic weather testing covers those conditions of variable wind pressures normally expected on the face of a building. The precise mechanics of wind forces on a building are not wholly determinate, as these forces vary rapidly according to the building shape and height, nearby structures and the surrounding terrain. Wind forces change rapidly and erratically due to these factors and the turbulence of the air current itself.

To further complicate matters, vibratory stresses set up by dynamic wind forces are more pronounced than static load analyses would indicate, and the impact caused by shifting and gusting winds on the face of a structure have shown the validity of higher wind-pressure values.

A standard test of 12 to 15 minutes of wind and water is sufficient to infiltrate an easily measurable quantity of water. Air infiltration of any window unit or facade may also be measured, but if the standard static air infiltration test has been carried out, this measurement is superfluous and not suitable for qualitative comparison.

Pivot impact tubes placed at the wind generator record the velocities at this point in miles per hour. Static tubes indicate pressures at the face of the unit. Rainfall apparatus record the amount of applied water and the water infiltration is measured. Deflection gauges placed about the test specimen record the movements of the skin and structure from the interior of the test building.

Another important consideration is the allowable deflection to be permitted in the individual skin units along with the allowable deflection of skin structural members. Wind-caused deflection in curtain walls of modern buildings is expected to be greater than the deflection of structural steel of the building. Sufficient clearance between structural members and the skin members should be allowed to obviate possible damage to plaster and other non-load bearing elements in the building.

From our experience over the past 10 years, the following is the recommended specification for the dynamic test:

1st phase—50 mph for 5 min. with 4" of water.

2nd phase—80 mph for 5 min. with 4" of water.

3rd phase—90 mph gusts for 3 min.

4th phase—120 mph gusts depending upon various conditions. This latter phase has also been performed without water in order to determine mph required to prove a particular glazing compound or pressure gasket, and the pressure at which a certain piece of glass will shatter.

(*Continued on page 22*)

## METHODS OF TESTING

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For comparative test purposes, it is assumed that pressure per unit area changes rapidly, is suddenly applied and erratic. The usual dynamic test velocity at the wind generator or engine exceeds 100 mph and the indicated mean pressure per unit area on the test specimen is 20 psf. This is an average value of the constantly changing dynamic pressures, and should be suitably recorded during the test. It must be noted that the approach velocity of a steady wind decreases rapidly as it approaches the face of the building.

In dynamic wind water tests, simulated rainfall is produced by introducing water into the vortex of the generator blade. This water is carried approximately horizontally until it strikes the face of the test specimen. This simulated rain can be measured in gallons per minute and adjusted to inches per hour for any number of conditions.

All this leaves us in the position of, "who's on first." If the specification writer or engineer is prone to the old school of "static load testing," we have a difficult situation. If he is more informed, more modern, the possibilities and the results could be more realistic, by specifying dynamic testing procedures, which are more nearly equivalent to the conditions and forces of nature.

## STATIC TESTS ON CURTAIN WALLS

*A paper presented at the 8th annual meeting of the Building Research Institute by E. R. McLaughlin, Associate Professor of Engineering Research, Pennsylvania State University.*

As soon as the exterior wall for a building is set up many forces start working to tear it down. More durable materials may stand for centuries with no maintenance or very little maintenance. Structures with ancient walls show a good design with proper use of materials to withstand the elements which attack them in their geographic location. Such designs and materials enjoy a reputation for durability which is based on many years of experience. These same designs and materials may be subject to economic changes which, if they don't cause price increases to raise the price beyond what the markets will bear, will certainly encourage the search for alternate designs and materials which cost less to fabricate and erect.

As the search uncovers new designs and materials which look attractive from the cost and performance points of view, the immediate question concerns durability and the answer is desired before time is available for an actual practical demonstration of durability and before the financial investment is too great.

To help evaluate the performance of new materials in curtain wall panels a series of tests has been developed to stress the panel at least as much as it is likely to be stressed in service and in some exposures there is a degree of acceleration to speed up the appearance of shortcomings if they are to develop. A test of this nature is a compromise between a mild exposure which has no acceleration and a severe test which is so accelerated that all good panels would fail. The test schedule to be described here has been billed on the program as a static method. This stems primarily from the method used to impose the simulated wind pressure differential. As you will see, the other features of the test program are quite dynamic as it is the intent of the cyclic sequence to make the panel flex and move to impose loads on gaskets and mastic materials, and stress on frame and facing materials to show the weak parts of the construction. One of the primary exposures on a wall panel is temperature difference. In a normal situation the air inside the building is maintained within 5 degrees of 75 F. It may be as low as 70 F in wintertime and may be continued at 78 to 80 F in the summertime. The exterior of the wall may be exposed to wintertime air as low as minus 20 F. Under summer solar radiation conditions the exterior surface of the panel may be heated as high as 150 F, depending to a great extent on the exterior surface color. To cover this temperature range the test cycle is programmed as follows, beginning with air and panel at temperatures of approximately 75 F.

(1) During a 9 hour period the air on the weather side of the panel is lowered to a temperature of minus 20 F. while the warm side air is held at 75 F.

(2) Heat lamps mounted approximately two feet from the panel are used to raise the exterior panel surface temperature to 150 F. With 250 watt lamps mounted on 12" centers this can be accomplished in approximately 5 hours.

(3) With the panel surface at 150 F a waterspray is directed onto the panel near its top and the water is permitted to run down across the panel picking up heat as it flows, quickly cooling the panel face. With spray water at 60 F the panel is cooled to 75 F or below in approximately 15 minutes.

(4) The heating of phase (2) is repeated. With warmer surroundings the panel surface reaches 150 F in approximately 4 hours 45 minutes.

(5) The panel is sprayed with water at 60 F for 15 minutes.

(6) The heating as described in phase (2) is repeated again for 4 hours 30 minutes.

(7) The panel is sprayed with water at 60 F for 15 minutes.

In this way a cycle of one cooling and three heating phases is completed in 24 hours. The timing can be altered if desired. A similar cycle can be completed in 18 hours or 12 hours to provide a greater number of cycles in a given time.

The final spraying leaves the panels very wet as they enter the freezing part of the cycle. While much of the surface water may evaporate before freezing, any water trapped in pockets or crevices is likely to freeze.

The panels are instrumental to permit observations of certain features during a typical cycle or perhaps at certain phases of each cycle.

There are approximately 200 thermocouples available to observe temperatures at locations of interest. These are not read continuously throughout the entire series but are read at close intervals for two or more cycles to provide typical temperature curves.

Similar data are recorded for deflection indicators mounted to show bowing of panels along the vertical and horizontal center line, or to show movement between panel and frame or mullions.

During the cold phase of the cycle observations are made for condensation which would indicate areas of poor thermal insulation. To assist in this observation the indoor relative humidity may be controlled at 35 or 40 per cent to provide the moisture for condensation. The boundary of the condensation area defines an isothermal line at a temperature equal to the dew point temperature of the atmosphere in contact with the surface.

Similarly the boundary between liquid condensate and frost defines the isothermal line at 32 F. At the beginning of each test and after each five cycles the wall is subjected to an air pressure differential while it is subjected simultaneously to a water spray down over the exterior surface. The air pressure differential is from a higher pressure outside to a lower pressure inside, the situation which would exist with a wind blowing against the exterior of the wall. The technique used in generating the pressure differential is of little consequence. With a maximum differential of 6" water gauge when the barometric pressure is nearly 400" of water the extreme variation in air density because of these pressure differentials would be 3 per cent. High winds usually accompany a low barometer, which situation makes the test practice of reducing the pressure on the room side of the wall more realistic. However, the practice of reducing the pressure on the room side developed more from ease of accomplishment than from any other rational sequence.

Pressure differentials were built up in one inch increments, with sufficient time at each interval for a detailed observation for minute leaks. As observations were completed the pressure differential was increased until the maximum of 6" was attained. The limit of 6" appears to be realistic. It is the velocity pressure of a 110 mph wind. As a wind blows against a wall perpendicularly the velocity head is converted to static pressure as the air piles up against the surface and establishes flow lines around the building. In converging on the down stream side of the building the air flow may create a negative pressure differential (inside to outside). Depending upon the interior arrangement of the building and the relative infiltration of the walls the actual pressure differential across the upstream wall may be more or less than the velocity pressure of the wind.

The pressure differential test has been the spectacular part of the program. It is a very quick demonstration of the adequacy of flashing arrangements. With the air pressure creating and maintaining 6" columns of water, any flashing which does not provide this protection will show water leakage. The proper location for wall panel vents is also demonstrated. Water will flow into or out of a panel in accordance with the pressure to which it is subject. In this case the water does not always flow down hill but may flow into the weep holes and up over a low flashing during sustained wind pressure. Under sustained pressure differentials gasket or mastic materials may be extruded from joints between panels and frame. Subsequent distortions by temperature and pressure variations open the joints and leaks develop. Experience indicates that 20 cycles is a minimum program to evaluate this sort of action.

The high temperatures created by the radiant heating may be used with no covering. During 10 or 15 cycles the mastic material along a vertical member may slump and flow creating a very unsightly condition prone to water leakage.

Pressure and temperature variations may also create uneven loading of the glass panels causing breakage and indicating need for modification in frame design.

Temperature cycling of the exterior surface of sandwich panels for curtain walls will indicate the adhesive's resistance to delamination. Metal facing materials with a relatively high coefficient of thermal expansion subject the adhesives to considerable shear stress. Once started, delamination progresses rapidly until the major portion of the stress is relieved. Further delamination occurs slowly. This discussion of possible difficulties which a new panel may encounter gives a pessimistic tone to the test program. Of equal or more value to the sponsor are the optimistic results which show that the panel and wall designs have withstood this mistreatment and the market can be approached with a new confidence that the wall will perform well.

# products, equipment, materials

*Reports of recent developments by industry, based on data furnished by mfrs. Inquiry cards for further information face pages 12 and 60.*

### Inherent color in aluminum sheets

MFR'S DESCRIPTION: *Number 80 Architectural Sheet* is gold-colored sheet of aluminum.

USES: exterior walls.

SPECS/FEATURES: non-fading color is stated to be inherent in alloy; not achieved through dying or other coloring agents. Available in standard embossed patterns in flat or coiled sheet form, in widths up to 60", in thicknesses from .060" to .125".

AIA file no. 17-A

MFR: KAISER ALUMINUM & CHEMICAL CORP.

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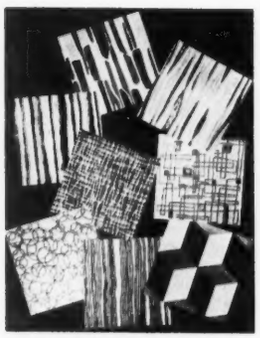


### Porcelain enamel panels for curtain walls

MFR'S DESCRIPTION: *Custom Design Series*, porcelain enamel panels in 8 standard patterns, is offered.

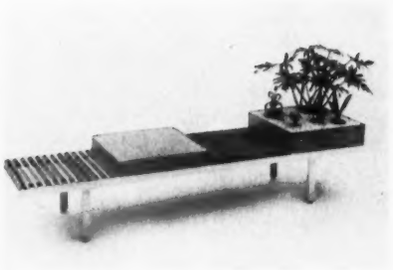
USES: curtain wall construction.

SPECS/FEATURES: panels permit flexibility in design, surface effects and colors. Surface durability and weather resistance are emphasized.

AIA file no. 17-A

MFR: BARROWS PORCELAIN ENAMEL CORP.

**Circle 42 for further information**



### Modular steel bench system

MFR'S DESCRIPTION: modular bench system for public areas, designed by George Nelson, AIA.

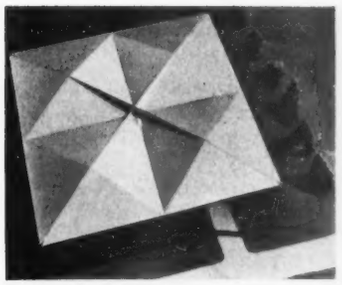
USES: waiting rooms, lobbies, hotels, museums, etc.

SPECS/FEATURES: system consists of various seating, table top and planter components and steel frame bases. Steel frame bases available in white or black enamel or stainless steel, in sizes to provide for 3 to 5 bench units, 20" square.

AIA file no. 28-A-2

MFR: HERMAN MILLER FURNITURE CO.

**Circle 43 for further information**



### Versatile aluminum gazebo

MFR'S DESCRIPTION: *Forecast* gazebo is adaptable aluminum structure.

USES: carport, summer house, boat house, commuter platform, barbecue shelter, etc.

SPECS/FEATURES: designed by Eliot F. Noyes, AIA, product is 20′ x 20′ roof structure of aluminum, supported by 4 thin aluminum columns. Construction is simple; unit can be easily relocated; is provided in colors and has varied adaptability.

AIA file no. 15-J

MFR: ALUMINUM CO. OF AMERICA

**Circle 44 for further information**

# products, equipment, materials

## CURTAIN WALLS

### Permanent color for aluminum sections

MFR'S DESCRIPTIONS: *Barcolor* system is method of applying color to aluminum windows and curtain walls.

USES: curtain wall construction.

SPECS/FEATURES: system consists of porcelain enameled aluminum covers which are applied to exterior face of framing, vertical and horizontal members. Covers can be supplied in stainless steel.

AIA file no. 17-A

MFR: E. K. GEYSER CO.

**Circle 45 for further information**

### Paneling facilities increased

MFR'S DESCRIPTION: steel, aluminum, stainless steel and laminated panels, with or without porcelain finishes, are now in production.

USES: curtain walls.

SPECS/FEATURES: *Laminall* process permits lamination of variety of exterior and interior surface sheets to almost any rigid core material. Process claimed successful with many materials and metals at temperatures up to 400°F.

AIA file no. 17-A

MFR: THE ERIE ENAMELING CO.

**Circle 46 for further information**

### Translucent plastic curtain wall

MFR'S DESCRIPTION: plastic sandwich panels with controlled translucency are available.

USES: curtain wall construction.

SPECS/FEATURES: panels are available with variety of face materials of Kraft, wood, plastic, metal or translucent foam. Many color and design variations are possible.

AIA file no. 17-A

MFR: ARCHITECTURAL PLASTICS CORP.

**Circle 47 for further information**

### Sliding sash for panel wall

MFR'S DESCRIPTION: *Sapphire* panel wall features horizontal sliding sash.

USES: one-story commercial, industrial and public buildings.

SPECS/FEATURES: with panel wall, individual sliding sash units containing panels are mullioned together to form walls for one-story construction. Panels of porcelain enameled steel, mosaic tile or opaque glass may be combined with glazing. U insulation factors reported to exceed those of 16″ masonry wall.

AIA file no. 17-A

MFR: PETERSON WINDOW CORP.

**Circle 48 for further information**

## MISCELLANY

### Lightweight insulating concrete

MFR'S DESCRIPTION: *Betocel* is cellular type, lightweight insulating concrete, composed of Portland cement, sand, water and *Betocel* emulsion.

USES: insulation in multi-storied buildings.

SPECS/FEATURES: density reported variable from 20 lbs pcf to 75 lbs pcf, and can be controlled within tolerances of less than 10 per cent. Mix consists of non-connecting, plastic lined air cells to provide dead air space for insulating purposes.

AIA file no. 37-D-3

MFR: REFLECTAL CORP.

**Circle 49 for further information**

### Beverage conveyor for hospitals

MFR'S DESCRIPTION: *RBLG Hot & Cold Foodveyer* is movable cabinet for hot and cold beverage and food service.

USES: hospital applications.

SPECS/FEATURES: unit is 29½″ wide, 72″ long and approximately 47″ high. Beverage glasses can be filled and delivered upright. Coffee dispensers are also contained.

AIA file no. 35-C-3

MFR: S. BLICKMAN, INC.

**Circle 50 for further information**

### Commercial/industrial water conditioners

MFR'S DESCRIPTION: *Miracle* water conditioning units provide automatic soft-conditioned water at same cost as manual units.

USES: commercial and light industrial installations.

SPECS/FEATURES: capacities range from 30 to 180 gallons per minute, based on 40 psi. Units can produce 10,800 gallons of conditioned water per hour; rust, iron and turbidity are also removed.

AIA file no. 29-D-32

MFR: WATER REFINING CO., INC.

**Circle 51 for further information**

### Reversible, rubber floor matting

MFR'S DESCRIPTION: *Akro Traffic-Master* is reversible rubber floor matting with high abrasion resistance.

USES: institutional and commercial buildings with heavy traffic.

SPECS/FEATURES: use of *Ameripol Micro-Black* masterbatch, oil-extended SBR copolymer, provides for abrasion resistance. Matting features molded ribbed 6″ squares to trap dirt and mud. Reverse side has horizontal ribs for gripping floor. Available in 30′ and 60′ rolls, 48″ wide.

AIA file no. 28-E

MFR: THE BUXBAUM CO.; GOODRICH-GULF CHEMICALS, INC.

**Circle 52 for further information**

### Molded plastic sanitary fittings

MFR'S DESCRIPTION: sanitary fittings are available, made of high-impact molded plastic.

USES: 4″ sewer and drain pipe.

SPECS/FEATURES: fittings are available in Y's, T's, 45° and 90° elbows and couplings. Stated to be water resistant, immune to rust and electrolytic corrosion.

AIA file no. 29-B-8

MFR: CARLON PRODUCTS CORP.

**Circle 53 for further information**

### Inflatable metal tubing

MFR'S DESCRIPTION: *Strubing* is light-wall seamless metal tubing designed to be shipped in ribbon form and inflated where used.

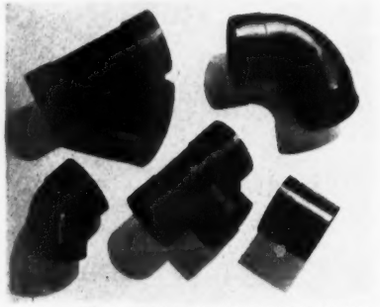
USES: varied piping and packaging installations.

SPECS/FEATURES: material

47 TRANSLUCENT PLASTIC CURTAIN WALL

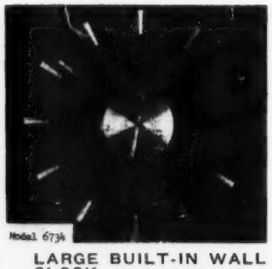
48 SLIDING SASH FOR PANEL WALL

49 LIGHTWEIGHT INSULATING CONCRETE



53 MOLDED PLASTIC SANITARY FITTINGS

54 INFLATABLE METAL TUBING




55 LARGE BUILT-IN WALL CLOCK

can be fabricated in wide range of diameters, in coil lengths as long as 15,000'. Can be inflated by hydraulic pressure, air pressure and mechanical means.
AIA file no. 29-B-41

MFR: WOLVERINE TUBE DIV., CALUMET & HECLA, INC.
**Circle 54 for further information**

### Large built-in wall clocks

MFR'S DESCRIPTION: 3 models of large, built-in wall clock line are offered.

USES: commercial applications.

SPECS/FEATURES: available in diameters from 15" to 24". Center discs, indicators and hands are satin aluminum or satin brass. Can be furnished to install from rear of wall.
AIA file no. 35-N-4

MFR: HOWARD MILLER CLOCK CO.
**Circle 55 for further information**

### Formboard has finished under surface

MFR'S DESCRIPTION: *Pyrotone* is mineral fiber formboard with finished under surface of plastic.

USES: roofing installations.

SPECS/FEATURES: finished surface reported suitable for ceiling; has acoustical absorption and light reflectance qualities. Material stated to support 2" poured gypsum roof deck with minimum deflection.
AIA file no. 19-D-3.

MFR: UNITED STATES GYPSUM CO.
**Circle 56 for further information**

### Prefabricated metal porches

MFR'S DESCRIPTION: nonskid steel plate is being used to prefabricate metal porches.

USES: residential applications.

SPECS/FEATURES: safety and durability are stressed. Reported to be cheaper than concrete units and competitive with those of wood. Non-skid surface is provided by ⅛" steel plate with checkered pattern, manufactured by Jones & Laughlin Steel Corp.
AIA file no. 15-H

MFR: STURDEE METAL PORCH CO.; JONES & LAUGHLIN STEEL CORP.
**Circle 57 for further information**

### Corrugated, permanent steel form

MFR'S DESCRIPTION: *Fab-Form* is corrugated permanent steel form designed for slabs poured over beams or joists.

USES: concrete floor and roof slabs.

SPECS/FEATURES: available in lengths up to 28' 3". Cover width is 32", and corrugations are ⅝". Fabricated from 27-gauge cold rolled, high-tensile strength steel, and supplied uncoated or coated with baked iron-oxide primer.
AIA file no. 4-D

MFR: PITTSBURGH STEEL PRODUCTS, DIV. PITTSBURGH STEEL CO.
**Circle 58 for further information**

### Safety switch reduces space requirement

MFR'S DESCRIPTION: bottom hinging and front operation on safety switches permit significant economies in space.

USES: locations of limited space.

SPECS/FEATURES: lack of projecting mechanism and hardware on sides is designed to permit ganging of devices. Bottom hinged cover detaches by removing only one screw.
AIA file no. 31-D-42

MFR: GENERAL ELECTRIC CO.
**Circle 59 for further information**

### Environmental test cabinets

MFR'S DESCRIPTION: *Hi-Lo Frigid-Cab* is environmental test cabinet, designed to produce drops in temperature to minus 110°F.

USES: testing processes on metals, rubber, plastics, etc.

SPECS/FEATURES: unit is stated capable of effecting temperature drops from room temperature to minus 110°F in less than five minutes. Available in 6 and 11 cu. ft. sizes and with temperature ranges from minus 100°F to room, or minus 100°F to plus 300°F.
AIA file no. 35-E-4

MFR: HUDSON BAY CO., DIV. OF LABLINE, INC.
**Circle 60 for further information**

### Fireproofing for metal roof decks

MFR'S DESCRIPTION: *Cafco Blaze-Shield* is inorganic mineral fiber blend for application to metallic or masonry surfaces.

USES: fireproofing structural steel elements.

SPECS/FEATURES: material is machine or gun-applied to surface where it forms light density blanket or coating. Said to be capable of eliminating sprinkler systems. Also has thermal insulation and sound conditioning properties.
AIA file no. 5-C

MFR: COLUMBIA ACOUSTICS AND FIREPROOFING CO.
**Circle 61 for further information**

### Movable storage/display carpet roll racks

MFR'S DESCRIPTION: *Trak-Rak* is designed to save floor space in storing and displaying carpet rolls.

USES: commercial uses.

SPECS/FEATURES: carpet is stored on racks suspended from

# products, equipment, materials

ceiling. When wanted for display, racks move from storage location, on monorail tracks in ceiling, to display area. Height of units varies to accommodate ceiling height.
AIA file no. 35-H-5

MFR: FLOOR COVERING EQUIPMENT DIV., CHICAGO TRAMRAIL CORP.
**Circle 62 for further information**

### Fire resistant coating for duct liners

MFR'S DESCRIPTION: fire resistant coating is now applied to *Ultralite* duct liners.

USES: fire protection.

SPECS/FEATURES: glass fiber liners are stated to have flame spread classification of less than 25, comply with requirements of National Board of Fire Underwriters and bear UL approval.
AIA file no. 30-D-4

MFR: GUSTIN-BACON MFR. CO.
**Circle 63 for further information**

### Recessed disposer outlets on sinks

MFR'S DESCRIPTION: *Carlrim* sink models feature disposer bowl designed to facilitate installation and operation of disposer units.

USES: residential kitchens.

SPECS/FEATURES: 2 sink models are available with disposer bowl at right or left. Rubberized coating on bowl's underside stated to reduce vibration from disposer operation.
AIA file no. 29-H-6

MFR: CARROLLTON MFG. CO.
**Circle 64 for further information**

### Portable stages and chair stands

MFR'S DESCRIPTION: line of portable stages and chair stands, *Model 4000*, is offered in modular sections.

USES: institutional use.

SPECS/FEATURES: sections

# products, equipment, materials

are reported interchangeable and capable of being locked together to produce platforms of various sizes and shapes. Can be stored in 16¼" x 48" area. Designed to support vertical live load of 100 lbs psf and withstand sway load of 27½ lbs per lineal foot of platform.
AIA file no. 35-F-11

MFR: SICO MFG., INC.
**Circle 65 for further information**

### Process for tinting glass in position

MFR'S DESCRIPTION: alkyd based formulation has been developed for flowing transparent color coating onto positioned window glass.

USES: sun heat, glare and fade control in varied locations.

SPECS/FEATURES: method is reported fast and clean; can be applied without interrupting normal business. Stated not to scratch, peel or chip during washing. Available in 8 colors.
AIA file no. 26-A-2

MFR: E. I. DU PONT DE NEMOURS & CO.; AMERICAN GLASS TINTING CORP.
**Circle 66 for further information**

### Sand and gravel pool filters

MFR'S DESCRIPTION: wide line of sand and gravel pool filters is offered.

USES: residential applications.

SPECS/FEATURES: 7 sizes range in diameter from 18" to 48", with ⅓ to 1½ hp pump and motor combinations. Features include: self-priming pump, galvanized piping and underdrain.
AIA file no. 29-D-31

MFR: IMPERIAL POOL EQUIPMENT CO., INC.
**Circle 67 for further information**

## LIGHTING

### Interference-free lighting panels

MFR'S DESCRIPTION: *E-C No. 70 Low Brightness Lens Panel* is glass lighting panel de-

signed to eliminate interference radiated from fluorescent lamps.

USES: laboratories, hospitals and similar areas housing sensitive equipment.

SPECS/FEATURES: unit, treated to serve as grounding shield, reported to transmit approximately 75 per cent of open troffer illumination. Panel is coated with transparent, electrically-conductive film which intercepts radiated interference and grounds it by silver strip around periphery of glass.

AIA file no. 31-F-28

MFR: CORNING GLASS WORKS

**Circle 68 for further information**

### Brackets/lanterns for outdoor lighting

MFR'S DESCRIPTION: outdoor bracket and lantern style lighting fixtures are offered, in colonial and modern designs.

USES: residential and commercial applications.

SPECS/FEATURES: housings are die-cast aluminum with rust proof anodized finishes. Construction is weather-resistant. Lights are either totally enclosed or open at top and bottom for thorough drainage.

AIA file no. 31-F-22

MFR: LIGHTOLIER, INC.

**Circle 69 for further information**

### Wide fluorescent lighting fixtures

MFR'S DESCRIPTION: *Futurliters* are 2' wide x 4' long fluorescent fixtures.

USES: store and office lighting.

SPECS/FEATURES: furnished in 4 and 6 light units with either louver diffuser bottoms or reversible prismatic louver-lens. Constructed of heavy-gauge, zinc coated steel. Listed by UL.

AIA file no. 31-F-21

MFR: EDWIN F. GUTH CO.

**Circle 70 for further information**

### Anodized aluminum outdoor fixture

MFR'S DESCRIPTION: *Post Top Light No. 4-100* is offered for uniform light distribution.

USES: exterior residential, commercial and institutional uses.

SPECS/FEATURES: may be used with standard incandescent, medium-base lamps up to 300 watts or with mercury vapor lamps through 250 watts. Features hinged cap to permit easy access to interior.

AIA file no. 31-F-22

MFR: MCPHILBEN LIGHTING, INC.

**Circle 71 for further information**

### Fixtures for suspension mounting

MFR'S DESCRIPTION: *Fairview* series is line of fluorescent fixtures for surface or suspension mounting.

USES: low ceiling applications in schools, offices, stores, etc.

SPECS/FEATURES: available in 4' and 8' models. Fixtures have clear, low brightness prismatic enclosure with translucent side diffusers to permit uplighting. Units feature externally fused ballasts.

AIA file no. 31-F-21

MFR: DAY-BRITE LIGHTING, INC.

**Circle 72 for further information**

### Rapid relamping for floodlights

MFR'S DESCRIPTION: line of *Power Beam* floodlights has spring construction to cut relamping time in half.

USES: ball fields, service stations, parking lots, building facades, etc.

SPECS/FEATURES: spring ejects old lamp at a touch; replacement snaps into position readily. Units are available with mounting devices for pole top or wall mounting, singly or in clusters.

AIA file no. 31-F-22

MFR: STONCO ELECTRIC PRODUCTS CO.

**Circle 73 for further information**

### Mercury vapor fixture for more light

MFR'S DESCRIPTION: *AA-51* is mercury vapor fixture reported capable of providing more light.

USES: oil refineries, chemical plants, coal mines, etc.

SPECS/FEATURES: fixture, with mercury vapor lamp, claimed to provide 2½ times as much light as normal. Available with 250 watt mercury vapor lamps. Choice of mountings, globes and guards.

AIA file no. 31-F-2

MFR: APPLETON ELECTRIC CO.

**Circle 74 for further information**

### Heavy-duty safety switch

MFR'S DESCRIPTION: *QMQB* safety switch, rated from 400 amps through 1200 amps, has a 100,000 amp interrupting capacity.

USES: industrial and commercial buildings.

SPECS/FEATURES: units are manually operated circuit interrupters employing a circuit breaker type operating mechanism in conjunction with fuses. Fuse holders are designed to accept either standard N.E.C. fuses or current limiting fuses.

AIA file no. 31-D-42

MFR: FEDERAL PACIFIC ELECTRIC CO.

**Circle 75 for further information**

### Aluminum/steel luminous ceiling

MFR'S DESCRIPTION: *Leaf-Lite Ceiling* is colored metal luminous ceiling.

USES: commercial and institutional ceiling applications.

SPECS/FEATURES: installation said to have textured appearance, without visible track system. Leafs are 3" wide, 6" deep, providing 45° shielding.

AIA file no. 31-F-231

MFR: LUMINOUS CEILINGS, INC.

**Circle 76 for further information**

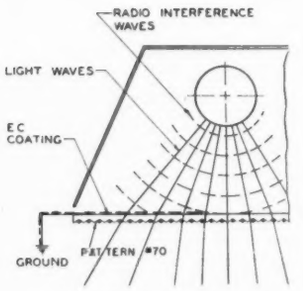
## HARDWARE

### Heavy duty hardware

MFR'S DESCRIPTION: line of heavy duty hardware permits installation of multifold doors or panels weighing up to 100 lbs.

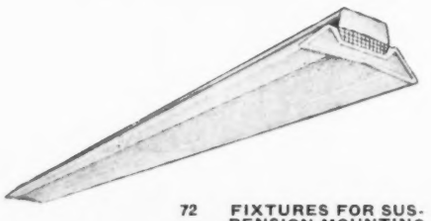
USES: on room dividers, folding closet doors and other accordion type doors.

SPECS/FEATURES: included are aluminum track, hangers,

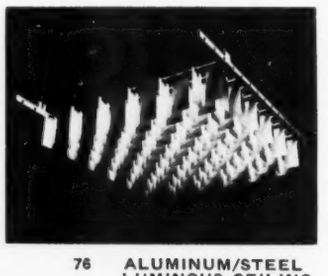



68 INTERFERENCE-FREE LIGHTING PANELS

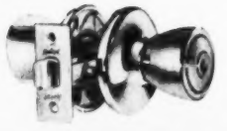
69 BRACKETS/LANTERNS FOR OUTDOOR LIGHTING



72 FIXTURES FOR SUSPENSION MOUNTING



76 ALUMINUM/STEEL LUMINOUS CEILING



78 LOCKSET SIZE INCREASED

pivots and pivot brackets, mortise hinges and flush type pull. Hardware is designed for use with doors or panels from 1" to 2¼" thick.
AIA file no. 27-A

MFR: MCKINNEY MFG. CO.
**Circle 77 for further information**

### Lockset size increased

MFR'S DESCRIPTION: *400 Line* locksets, in *Bel Air* or *Standard* designs, have larger diameter of 2⅝".

USES: residential uses.

SPECS/FEATURES: larger size said to permit installation in either 2" or 2⅛" holes, with sufficient overlap to conceal possible frayed edges around bore.
AIA file no. 27-B

MFR: KWIKSET SALES AND SERVICE CO., SUBS. THE AMERICAN HARDWARE CORP.
**Circle 78 for further information**

### Door-installed door closer

MFR'S DESCRIPTION: *Multi-check* is door-installed door closer, adaptable to various installations.

USES: interior wood and hollow metal doors.

SPECS/FEATURES: features straight one-piece arm which functions on traveling spindle to relieve leverage stress on butts and door frame. May be adjusted to any of 7 hold-open positions from 85° to 130°.
AIA file no. 27-B

MFR: THE OSCAR C. RIXSON CO
**Circle 79 for further information**

## HVAC

### Dual purpose unit for spot cooling

MFR'S DESCRIPTION: *HB* unit is dual purpose air handling unit in 2, 3, 4 and 5 ton sizes.

USES: heating systems.

SPECS/FEATURES: units utilize fans with low tip speed to achieve maximum air velocities at low noise level. Condensate pump is available. May be suspended or installed in horizontal duct work.
AIA file no. 30

MFR: FRASER-JOHNSTON CO.
**Circle 80 for further information**

### Low voltage zone control

MFR'S DESCRIPTION: *Zone-A-Trol Heating-Cooling By-Pass Valve* is low voltage, thermostat operated zone control.

USES: hydronic heating and cooling systems.

SPECS/FEATURES: designed to automatically control flow of heating or cooling into unit. Product is designed for use on systems operating at pressures up to 250 lbs.
AIA file no. 30-E

MFR: ECONO PRODUCTS CO., DIV. VIKING INSTRUMENTS, INC.
**Circle 81 for further information**

### Heating/ac roof-mount units

MFR'S DESCRIPTION: line of packaged roof-mount air conditioning and heating units is available.

USES: single-story stores.

SPECS/FEATURES: cabinet is 16 gauge galvanized steel, bonderized and painted. Units are sized 5, 7½, 10 and 15 tons, either gas or oil fired.
AIA file no. 30-F-2

MFR: VENTIL-AIRE CORP.
**Circle 82 for further information**

## ALUMINUM ITEMS

### Finishes for aluminum extrusions

MFR'S DESCRIPTION: *Duranodic* finishes for use on 6063 alloy aluminum extrusions are available.

USES: exterior aluminum surfaces, such as store fronts and handrails.

SPECS/FEATURES: coating's hardness is claimed superior to other anodized finishes. Tones range from bronze-silver to bronze-black, depending on thickness.
AIA file no. 15-E

MFR: ALUMINUM CO. OF AMERICA
**Circle 83 for further information**

### Extruded aluminum weldments

MFR'S DESCRIPTION: recently developed machine makes possible extruded aluminum weldments for square or rectangular box columns.

USES: functional design.

SPECS/FEATURES: machine welds channel joints internally, along entire length. Weld reported not to penetrate to exterior, causing no grinding or polishing of surface. Practically any metal can be used.
AIA file no. 15-J

MFR: CECIL P. PECK CO.
**Circle 84 for further information**

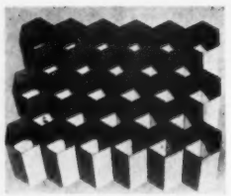
### Treatment for aluminum extrusions

MFR'S DESCRIPTION: *Anocote* is process developed to protect aluminum extrusions.

USES: extrusion protection during shipping, storing and handling.

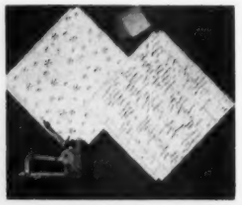
SPECS/FEATURES: finish is supplied only on alloy 6063. Stated not to alter natural color of the metal; may be used as final surface. Smooth surface free from defects, after anodizing or etching is stressed.
AIA file no. 15-E

MFR: HARVEY ALUMINUM
**Circle 85 for further information**

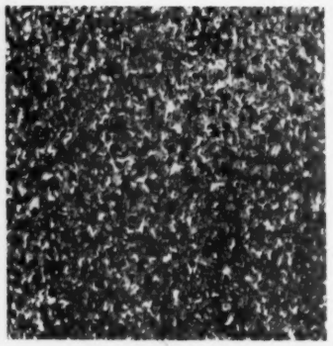


86 HEXAGONAL ALUMINUM PANEL SCREEN

87 SELF-CONTAINED THREE LINE TELEPHONE



90 ACOUSTICAL CEILING TILES



91 CORK/VINYL FLOOR TILE

94 PORTABLE GAUGE FOR SOIL CLASSIFICATIONS

# products, equipment, materials

### Hexagonal aluminum panel screen

MFR'S DESCRIPTION: *C/S Honeycomb-Hex* is panel screen formed from aluminum sheet, having standard 2" hex, 4" in depth.

USES: decorative screen, vision screen, sun shade, etc.

SPECS/FEATURES: panels can be fabricated with cells normal to plane or set at any angle. Unsupported 8' x 20' panels stated to show no visible deflection under wind load. May be interlocked and supported for larger areas.

AIA file no. 35-P-1

MFR: CONSTRUCTION SPECIALTIES, INC.

**Circle 86 for further information**

## OFFICE UNITS

### Self-contained three line telephone

MFR'S DESCRIPTION: *Type 87 Key Telephone* is self-contained, three-line telephone with hold feature on each line.

USES: small business offices.

SPECS/FEATURES: multiple line pick-up and hold features without separate control relays for each feature stated to be economic advantage. Designed for use on P-A-X, P-A-B-X or central office lines. Available in black and 10 colors.

AIA file no. 31-i-51

MFR: AUTOMATIC ELECTRIC, SUBS. GENERAL TELEPHONE & ELECTRONICS

**Circle 87 for further information**

### Medium-volume whiteprinter

MFR'S DESCRIPTION: *Copyflex Model 435* is medium-volume whiteprinter of welded, reinforced, heavy gauge metal.

USES: drafting offices.

SPECS/FEATURES: features 42" printing width, 3,000 watt lamp and mechanical speed ranging up to 40' per minute. Conveniences include air-jet separator which automatically separates tracings from prints after exposure, and foot treadle for releasing incorrectly fed stock.

AIA file no. 35-H-3

MFR: CHARLES BRUNING CO., INC.

**Circle 88 for further information**

### Computer system for commercial operations

MFR'S DESCRIPTION: *Univac Solid State 90* computer is offered for punched card installations.

USES: office and commercial uses.

SPECS/FEATURE: system uses 80-column punched cards; reads words at rate of 58,800 per second, and adds numbers at 11,760 per second. May co-ordinate production, billing, sales analysis and inventory into one procedure.

AIA file no. 35-H-4

MFR: REMINGTON RAND DIV., SPERRY RAND CORP.

**Circle 89 for further information**

## TILES

### Acoustical ceiling tiles

MFR'S DESCRIPTION: *Starlite* and *Driftwood* patterns are added to *Forestone* line of acoustical ceiling tiles.

USES: sound control.

SPECS/FEATURES: tiles are of fissured wood fiber, 12" x 12", with flange joint for stapling application, or with butt edge for adhesive application. Said to be capable of painting without loss of sound absorbency.

AIA file no. 39-B

MFR: SIMPSON LOGGING CO.

**Circle 90 for further information**

### Cork/vinyl floor tile

MFR'S DESCRIPTION: *Decorlite* is low-cost tile available in 6 patterns.

USES: residential floors.

SPECS/FEATURES: composed of cork base, with laminated prestressed vinyl surface, tiles are 9" x 9" in 3/32 gauge. Patterns combine color with cork backgrounds.

AIA file no. 23-G

MFR: DODGE CORK CO., INC.

**Circle 91 for further information**

### Antiseptic added to vinyl flooring

MFR'S DESCRIPTION: *Amti-Septic* germproofing has been added to *Amtico* vinyl flooring line.

USES: hospitals and similar applications.

SPECS/FEATURES: tests have shown product to be effective against staphylococcus aureus and salmonella typhosa. Available, at extra charge, in terazzo, marble and plain colored tiles.
AIA file no 31-J-1

MFR: AMERICAN BILTRITE RUBBER CO.
**Circle 92 for further information**

### Rubber stair tread use

MFR'S DESCRIPTION: use of rubber stair treads announced for window sill coverings.

USES: window sill protection.

SPECS/FEATURES: stated to offer durability, low initial cost, easy installation and maintenance. Can be matched to floor tile color.
AIA file no. 14-D-1

MFR: R. C. A. RUBBER CO.
**Circle 93 for further information**

## TESTING UNITS

### Portable gauge for soil classifications

MFR'S DESCRIPTION: model *CL-700 Pocket Penetrometer* is offered for determining bearing capacity of cohesive soils.

USES: soil tests in the field.

SPECS/FEATURES: features maximum recording ring, direct reading scale in unconfined compressive strength or bearing capacity in tons psf or kilograms per square centimeter and compact size.
AIA file no. 38-B

MFR: SOILTEST, INC.
**Circle 94 for further information**

### Electro-hydraulic compactor

MFR'S DESCRIPTION: an electro-hydraulic compactor, developed by Soiltest, Inc., featuring "kneading action," and offering flexibility in preparation of test specimens.

USES: preparation and compaction of samples of bituminous mixes, asphaltic concrete, soils and similar materials.

SPECS/FEATURES: to provide flexibility, compactor has adjustable compaction foot pressures, adjustable time of dwell on specimen and variable rate of compaction. Both 4" and 6" diameter molds with separate compacting foot for each mold are provided. Other features stated are automatically indexing mold table, predetermined cut-off counter, pressure dwell timer adjustable to a variety of dwell periods and automatic and manual operation air pressure regulators. Unit is small and can be mounted on floor or table, according to mfr.
AIA file no. 38-E

MFR: SOILTEST, INC.
**Circle 95 for further information**

## DOORS/WINDOWS

### Window frame includes accessory tracks

MFR'S DESCRIPTION: four-track sliding window includes storm and screen tracks in single frame.

USES: residential installations.

SPECS/FEATURES: storm tracks are integral part of window frame; storm sash can be supplied at original installation. Panels are inserted from inside without tools; cannot be removed from outside. Reported applicable to brick, frame or masonry construction.
AIA file no. 35-P-12

MFR: CAPITOL PRODUCTS CORP.
**Circle 96 for further information**

### Anodized aluminum window series

MFR'S DESCRIPTION: 2 types of aluminum windows are offered in standard sizes.

USES: awning, casement and basement type installations.

SPECS/FEATURES: *Series 1000* windows are designed with integral fin, serving as nail-in flange in masonry construction. *Z-Bar* windows are for use in applications with tubular mullions; may be set at any angle. Have anodized finish.
AIA file no. 16-E

MFR: VENTILAIRE PRODUCTS CO.
**Circle 97 for further information**

### Translucent garage door

MFR'S DESCRIPTION: *Filuma* is sectional overhead garage door, combining translucent, fibrous glass and extruded aluminum frame.

USES: residential garages.

SPECS/FEATURES: stated to weigh ⅓ as much as wood, facilitating installation. Features include weather resistance and freedom from warping or binding. Available in 10 sizes to fit conventional single and double width openings.
AIA file no. 16-D

MFR: FRANTZ MFG. CO.
**Circle 98 for further information**

### Interior/exterior tile for window sills

MFR'S DESCRIPTION: *Hermosa* tile, in 2 colors, is offered for window sills.

USES: interior and exterior sills in homes, schools, etc.

SPECS/FEATURES: tile stated to be impervious to stain, rust,

blister, fading, wear and weather. Supplied in sections 11 15/16" x 5⅞" with left and right angle stop sections.
AIA file no. 23

MFR: GLADDING, MCBEAN & CO.
**Circle 99 for further information**

### Dumbwaiter doors with 1½ hr rating

MFR'S DESCRIPTION: line of dumbwaiter doors has 1½ hr UL rating.

USES: electric and manual dumbwaiter hoistway openings.

SPECS/FEATURES: line includes bi-parting, hinged type, machine access and cleanout doors. Latch, vision panel, push buttons and signal light are mounted in frame. Guide shoes and need for field adjustment said to have been eliminated.
AIA file no. 33-G-5

MFR: SEDGWICK MACHINE WORKS, INC.
**Circle 100 for further information**

### Sliding, flush firedoor

MFR'S DESCRIPTION: *Pyrodor* is sliding unit with solid mineral core construction for low heat transmission.

USES: industrial applications.

SPECS/FEATURES: classified by UL for 3 hr fire rating. Interlocking panels are designed for simplification of shipping and assembly. Corrosion-resistance and durability emphasized.
AIA file no. 16-B

MFR: DUSING & HUNT, INC.
**Circle 101 for further information**

## SEALANTS

### Synthetic rubber sealants

MFR'S DESCRIPTION: series of polysulfide base synthetic rubber sealants, *Structureseal nos. 1175* and *1176*, are offered.

USES: glazing sealouts, joint sealers in masonry construction and sealing compounds for curtain walls.

SPECS/FEATURES: product is available in ranges for normal and extreme expansion and contraction. Also in variable work times to compensate for weather conditions.
AIA file no. 24-E

MFR: PRESSTITE-KEYSTONE ENGINEERING PRODUCTS CO.
**Circle 102 for further information**

### Reinforced synthetic rubber tape

MFR'S DESCRIPTION: *U-100* sealing tape is synthetic rubber tape, reinforced with nylon fibers.

USES: curtain wall fabrication.

SPECS/FEATURES: use of tape reported to eliminate use of screws in porcelain exterior panels. Material stressed as resistant to oxidizing and hardening, permanently flexible and features adhesion to such surfaces as glass, aluminum and brass.
AIA file no. 24-E

MFR: UNITED STATES RUBBER CO.
**Circle 103 for further information**

## FIXTURES

### Turret service fixture for laboratories

MFR'S DESCRIPTION: *Model BL-4150 Vari-Outlet Turret* with hose cocks, a laboratory service fixture, has been added to *Lab-Flo* line.

USES: educational, research and industrial laboratories.

SPECS/FEATURES: unit, with ⅜" IPS female inlets, accommodates two services from one fitting source—two-way at 90° or 180°, or four-way if desired. Color coded index buttons identify respective services for gas and air, gas and vacuum, air and vacuum, etc. Furnished with heavy chrome plating, and is available with heavy duty hose cocks if specified.
AIA file no. 35-E

MFR: T & S BRASS AND BRONZE WORKS, INC.
**Circle 104 for further information**

### Vitreous china oval basin

MFR'S DESCRIPTION: *Ovalyn* is oval basin of vitreous china, in white or 8 colors.

USES: residential bathrooms.

SPECS/FEATURES: units measure 5½" in depth; are available with inside dimensions 17" x 14" or 19" x 15". Drain outlet has been placed in rear; overflow in front.
AIA file no. 29-H-6

MFR: AMERICAN-STANDARD PLUMBING & HEATING DIV.
**Circle 105 for further information**

### Adjustable shower head

MFR'S DESCRIPTION: *Flex-Mate*, adjustable shower head, is offered for use with *Flex-Arm* shower extension.

USES: residential shower applications.

SPECS/FEATURES: mechanical parts which become difficult to adjust after exposure to unfavorable water conditions have been removed. Push-pull action adjusts water flow from full flow to hard or soft spray.
AIA file no. 29-H-3

MFR: SHUR-LOCK HOME PRODUCTS CO.
**Circle 106 for further information**

### Service fixture for hot water

MFR'S DESCRIPTION: *Lab-Flo Model BL-6100-1* is fixture designed to furnish warm to hot water rapidly.

USES: laboratory applications.

SPECS/FEATURES: gooseneck unit has floating stainless steel cones and stainless steel seats in both valves, with ½" IPS female inlets on 6½" centers. Removable, serrated hose tip said to provide secure connection.
AIA file no. 35-E

MFR: T & S BRASS AND BRONZE WORKS, INC.
**Circle 107 for further information**

### Interchangeable laboratory fixture

MFR'S DESCRIPTION: *Model BL-4200* is laboratory turret fixture.

USES: school and industrial laboratories.

SPECS/FEATURES: designed for gas, air or vacuum.
AIA file no. 35-E

MFR: T & S BRASS AND BRONZE WORKS, INC.
**Circle 108 for further information**

## MISCELLANY

### Self-guiding mechanical rake

MFR'S DESCRIPTION: mechanical rake is offered for cleaning debris from trash racks or screens.

USES: pumping, processing and sewage disposal installations.

SPECS/FEATURES: unit is said to be self-guiding, self-clearing and self-dumping. Can be started and operated automatically by remote control. Depths available up to 100'.
AIA file no. 29-C-8

MFR: FRANK W. STUKER AND ASSOCIATES
**Circle 109 for further information**

### Underhung crane for varied tracks

MFR'S DESCRIPTION: *Meco-Matic* crane is operable on 40 standard structural I-beam sizes, wide flange beams and hardened monorail track.

USES: material handling.

SPECS/FEATURES: adaptability is due to free-floating flangeless wheels and side guide rollers which bear against the web of the beam rather than against the flange. Units may be motor driven, hand geared or of the push type.
AIA file no. 35-i-12

MFR: MECHANICAL EQUIPMENT CO.
**Circle 110 for further information**

### Holepuncher for difficult locations

MFR'S DESCRIPTION: "sliding weight" holepuncher has been developed for wellpoint installation.

USES: in "difficult to penetrate" soils. Of value to structural and site engineers.

SPECS/FEATURES: stated to be economical and practical on sites characterized by cemented gravel, boulders, concrete, rubble and layers of hard limestone and sandstone.
AIA file no. 36

MFR: GRIFFIN WELLPOINT CORP.
**Circle 111 for further information**

THE ANATOMY OF A NEW PROJECT

# preview: 10

| | |
|---|---|
| *UNION CARBIDE HOME OFFICE BUILDING* | *project* |
| *UNION CARBIDE CORPORATION* | *client* |
| *SKIDMORE, OWINGS AND MERRILL* | *architects* |
| *WEISKOPF AND PICKWORTH* | *structural engineers* |
| *SYSKA AND HENNESSY* | *mechanical and electrical engineers* |
| *GEORGE A. FULLER CO.* | *general contractor* |

## General description

Towering above its neighbors on Park Avenue, the Union Carbide Building will provide international headquarters and an imposing corporate symbol for this world-wide chemical manufacturing firm. The building will consolidate offices of the company now located in 14 buildings in the Grand Central area and will provide room for future expansion of the corporation's activities. A total of 1,500,000 square feet of space and a rentable area of 1,100,000 square feet will provide office space for some 5,000 people, including Union Carbide employees and tenants. Located on the block between Madison and Park Avenues, from 47th to 48th Streets (400 feet by 200 feet), about two-thirds of the structure straddles the tracks leading to and from Grand Central terminal. When completed in mid-1960, the building will be the tallest on Park Avenue and among the ten tallest in the world.

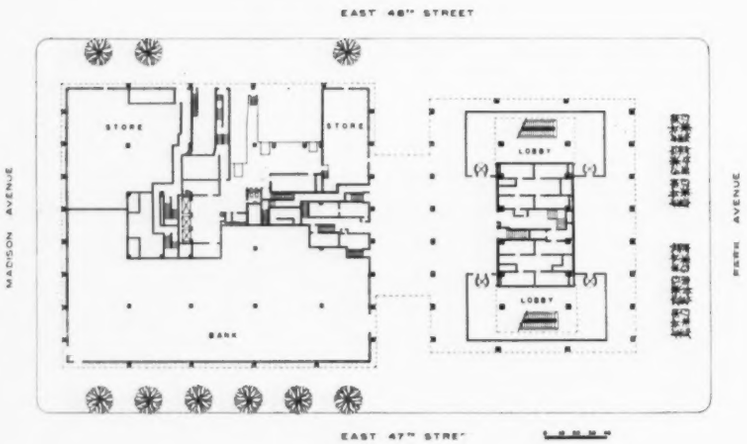
Set back from the street, creating an attractive plaza area, the project is composed of a 52-story single-block tower facing Park Avenue which is connected to a 12-story section facing Madison Avenue. Executive offices of Union Carbide and its divisions will occupy 40 floors of the tower and all of the 12-story Madison Avenue section. Tower floors 14 through 24 will be leased to tenants. The Park Avenue tower is linked by a protected arcade to the Madison Avenue structure. The broad plaza expanse (50 feet deep on the Park Avenue side and 33 feet deep on 47th and 48th Streets) will be paved with terrazzo. Escalators will carry persons from the street level to a spacious second floor lobby and exhibit area for Union Carbide scientific and technological displays. Commercial frontage will be furnished on Madison Avenue and off-street loading facilities on 48th Street.

## Plan elements

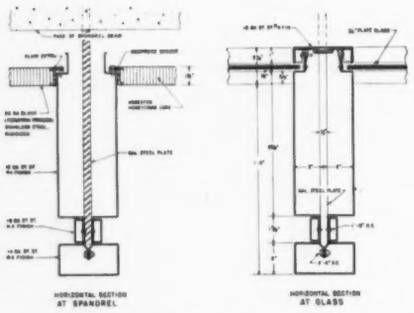
The entire structure is designed on five-foot modules. The curtain wall exterior comprises natural-finish stainless steel mullions 5 foot o.c. with spandrels of black-matte stainless steel. Every fifth mullion is designed to serve as a track for guiding a window-cleaning platform. Columns are mainly 20 foot o.c. with some spaced more than that and a few as far apart as 45 feet.

The interior design of the building affords great flexibility as movable partitions will be used almost exclusively. Office and work areas will be in modules of 5 feet. While the partitions will be an integral part of the over-all design, they are designed to be taken down and reassembled in a minimum amount of time. Constructed of steel and glass with stainless steel trim, partitions will feature various design schemes through-

*(Continued on page 34)*




Plan at ground floor




Typical skin details

out the building. Panel surfaces will be of wood veneers, plastic laminates, and painted metal. Partitions are 2 inches thick, composed of panels detailed with a solid lower section 7 foot high, topped with a section of clear plate glass extending to the ceiling. Panels are joined by clips that engage the reinforced edge of the panel to form what is known as a "universal post system." The ceiling consists of plastic lighting fixtures in an over-all pattern spaced by ceiling runners on 5 foot centers.

An employee's cafeteria will be contained in the Madison Avenue section with a cafeteria and table serving area of about 1,300 seats. Dining areas on the second floor will occupy about 33,150 square feet, with space on the third floor for kitchen facilities. Because of the two-floor operation, emphasis will be on mobility. Wide use will be made of solid dish conveyors, dumb waiters, electrically heated mobile cabinets for transport of hot foods, and portable racks instead of shelving. The kitchen and dining areas will be soundproofed. Use of pocket radio receivers by key restaurant personnel will eliminate need for loud speaker systems.

There will be 24 passenger elevators, four escalators, and five freight elevators employed. The tower will be served by 16 passenger elevators and two freight elevators. The Madison Avenue structure will have eight passenger elevators and three freight elevators. Because of the location of the Grand Central railroad tracks, the elevator pits for the tower section will be located on the ground floor with escalators connecting the street level to the lobby.

## Structural information

The building of bolted steel and curtain wall construction rests on 115 steel columns set in bedrock. Each of the columns rests on lead anti-vibration pads to cushion the building from vibrations from trains.

The curtain wall units are pre-assembled complete with window frames, spandrel and column panels. The sandwich panel spandrels consist of textured stainless steel outer sheet, an impregnated asbestos honeycomb core, and an aluminum back-up sheet. Each unit is 13 feet high by 5 feet wide, and weighs less than 150 pounds, exclusive of glass. Glazing is done after units are installed. The spandrel panels are colored black by the Permyron® process, a method of applying permanent color to the surface of metals that was developed by Union Carbide Metals Co., a division of the parent corporation. The black stainless steel surface is protected during fabrication and construction by a stripable plastic coating that will be removed after all the panels have been installed and exterior work completed. The walls are 1¼ inches thick, backed-up by structural steel spandrel beams.

All the floors of the tower building are constructed of 2½ inch concrete topping on 3-inch deep light gauge cellular steel decking. A blanket of mineral fiber fireproofing, sprayed directly to the underside of the cellular floor, provides 3-hour fire protection for the floor. Steel beams supporting the cellular floors are protected with a cage of vermiculite gypsum plaster on metal lath.

## Heating, ventilating and air-conditioning

The air-conditioning system will have a total refrigeration capacity of 5,000 tons, with two 1,000 ton units on the 51st floor and three 1,000 units in a sub-basement on the Madison Avenue side. All five are centrifugals, with steam turbine drive. Perimeter heating and cooling is to be by a high velocity conduit system with induction units. The interior system will have fan rooms on the 12th to 13th floors, 34th to 35th floors, and the roof. Vertical supply ducts are to be of the dual type, with single ducts furred into the ceiling on each floor, zoned for exposure, occupancy, and convenience. Thermostatic control for each zone will be from the return temperature.

The engineers have calculated that due to the large solar heat gain through the glass walls, plus the great gain from other sources, cooling will be required most of the year, with little need for heat until the outside temperature approaches 20° F. Since there are few days in New York City when the temperature remains that low, the summer cycle will be used throughout the entire year. This eliminates heat exchangers for heating the water. Also, there will be no changeover period.

# literature

*Literature cited in this department is available from various manufacturers and associations free of charge. To obtain copies, circle the keyed numbers on the reader service cards facing pages 12 and 60.*

### Cement uses

Recent catalog details uses and applications of *Atlas White Portland Cements* in construction and manufacturing. Included is information on white Portland cement in architectural concrete, terrazzo, cement stucco, cement paints, faced concrete block, asbestos-cement products, masonry mortar and cold-glazed wall finishes. (24 pp.)
AIA file no. 3-A-23
MFR: UNIVERSAL ATLAS CEMENT DIV., UNITED STATES STEEL CORP.
**Circle 112**

### Marble tile

Reference brochure on *Markwa* tile, ½" thick quarried marble, is available as color and pattern guide. Tile can be set in same manner as clay tile, by either mortar or adhesion. Available in 12" x 12", 8" x 8" and 12" x 8" sizes, and high gloss and satin finishes. Price is $1.00. (12 pp.)
AIA file no. 23-N
MFR: VERMONT MARBLE CO.
**Circle 113**

### Marble brochure

*Marble Forecast* brochure for 1959 and 1960 is available to architects and engineers. Literature lists domestic and foreign marbles which are currently available in U. S. Information on texture and color characteristics is included. (8 pp.)
AIA file no. 22
ASSN: THE MARBLE INSTITUTE OF AMERICA, INC.
**Circle 114**

## CURTAIN WALLS

### Aluminum grating

Literature printed on aluminum foil introduces *Anotec*, architectural anodized aluminum grating. Material is designed for applications on both building interiors and exteriors. Uses include sun shades, wall panels, room dividers, grilles and louvers. Available in colors. (6 pp.)
AIA file no. 14-A-1
MFR: KLEMP INTERNATIONAL DIV., KLEMP METAL GRATING CORP.
**Circle 115**

### Laminated panels

Current literature describes four types of insulated laminated sandwich panels for curtain wall construction. Units are available in combinations of fibrous glass, metal and cement asbestos board. Unicellular plastic core is used for insulation. Color range is unlimited. (4 pp.)
AIA file no. 17-A
MFR: PREMIER PANELS, INC.
**Circle 116**

### Curtain wall details

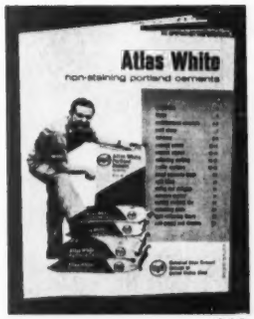
Current literature provides extensive detail drawings of aluminum and steel curtain wall systems. Installation details cover panel arrangements, ventilating areas and fixed windows in single and multi-story structures. Specifications included. (24 pp.)
AIA file no. 17-A
MFR: CECO STEEL CORP.
**Circle 117**

### Stainless steel systems

Booklet on stainless steel contains ideas for stainless steel usage in architectural field. Curtain wall design and applications on specific buildings are shown in illustrations. Detailed drawings on unusual problems, representing major architects, are explained. (52 pp.)
AIA file no. 17-A
MFR: ALLEGHENY LUDLUM STEEL CORP.
**Circle 118**

### Curtain walls/windows

Topical fact sheet is offered on *Barcolor* system for applying permanent color to windows and curtainwalls and improving weathering characteristics



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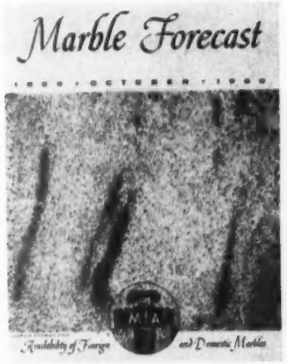

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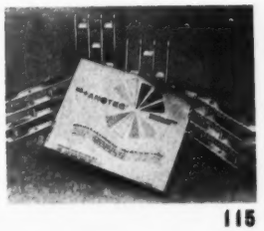

115

of exposed surfaces. Colored units are of stainless steel, porcelain enamel on aluminum and color anodized aluminum; attach without exposed fastenings. (2 pp.)
AIA file no. 17-A
MFR: E. K. GEYSER CO.
**Circle 119**

### Curtain wall folder

File folder is offered, treating cast panel construction for curtain walls and fascia panels. System, reported to incorporate sculptured qualities of castings into standard metal wall components. Folder contains engineering details and specifications.
AIA file no. 17-A
MFR: THE MICHAELS ART BRONZE CO., INC.
**Circle 120**

### Curtain wall grid systems

Booklet explaining grid system of construction for curtain walls and windows, contains specifications and notable installations of system. Design features and procedures are detailed, and related products are noted. (20 pp.)
AIA file no. 17-A
MFR: E. K. GEYSER CO.
**Circle 121**

### Colored exteriors

*Alumalure*, baked enamel finish, is described in recent literature. Designed for application to aluminum curtain wall panels, finish is offered in 11 colors, intended to withstand weathering. (4 pp.)
AIA file no. 12-C
MFR: ALUMINUM CO. OF AMERICA
**Circle 122**

### Aluminum wall systems

Recent booklet lists available forms of aluminum for curtain wall construction, together with check list of considerations for curtain wall design.

# literature

Finishes and types of panels are described. Information is based upon previous applications. (12 pp.)
AIA file no. 17-A

MFR: ALUMINUM CO. OF AMERICA
**Circle 123**

### Aluminum screen

Recent file folder presents elevations, detail drawings and photographs of aluminum sunscreen wall system on the Main Public Library, New Orleans, La. Specifications and design considerations are included.
AIA file no. 17-A

MFR: ALUMINUM CO. OF AMERICA
**Circle 124**

## SEALANTS/TREATMENTS

### Protective coatings

Specialized protective coatings brochure is available, to aid correct coating choice for exterior and interior surfaces. Among walls and surfaces covered are concrete block, brick, concrete, plaster, drywall, acoustical materials and cement asbestos board. Chart lists such salient features as texture, design and construction details and surface preparation.
AIA file no. 4-D-4

MFR: SUPER CONCRETE EMULSIONS LTD.
**Circle 125**

### Joint compounds

Data and specifications of cold applied *Sewertite* asphalt base and tar base joint compound for sewer pipe, culvert and septic tank joints of concrete, vitrified clay and tile are presented in concise bulletins. Information includes performance data regarding nonvolatile matter, inorganic filler, chemical resistance and application. (2 sheets)
AIA file no. 29-C-2

MFR: THE PHILIP CAREY MFG. CO.
**Circle 126**

### Caulking/glazing compound

Topical brochure contains application and test data on *Kaukit*, caulking and glazing compounds with alkyd resin base. Product remains air-tight, flexible and elastic for long periods; is available in gun grade consistency for application with standard caulking gun. Recommended for residences,

# literature

commercial buildings, schools, hospitals, apartment and office buildings. (4 pp.)
AIA file no. 7-D

MFR: BUILDING PRODUCTS DIV. L. SONNEBORN SONS, INC.
**Circle 127**

### Concreting problems

Current publication enumerates concreting problems and resolutions experienced on 12 tunneling projects. Role of *Pozzolith*, concreting admixture, is described for each different case. (28 pp.)
AIA file no. 4-B

MFR: THE MASTER BUILDERS CO.
**Circle 128**

### Masonry treatments

Specification guide enumerates line of waterproofing, protective and corrective treatments for masonry. *Thoro* system includes 17 products for varied uses. Applications are noted and specifications provided. (20 pp.)
AIA file no. 7

MFR: STANDARD DRY WALL PRODUCTS, INC.
**Circle 129**

### Joint sealants

*Waterstops*, for sealing construction joints and expansion joints in concrete, are described in current literature. Drawings and tables provide information regarding properties and applications. (4 pp.)
AIA file no. 4-E-11

MFR: WILLIAMS EQUIPMENT AND SUPPLY CO., INC.
**Circle 130**

## HVAC

### Return air system

Illustrated bulletin relates manner in which make-up air, properly introduced and tempered, will overcome negative air pressure and consequent problems. Bulletin outlines design of make-up air system and equipment selection. (4 pp.)
AIA file no. 30

MFR: REZNOR MFG. CO.
**Circle 131**

### Refrigeration condenser

Manual describing *Airvec* unit is offered. Unit is air conditioning or refrigeration condenser, requiring no

# literature

motors, fans, water or maintenance. Included is explanation of operating principle, operating advantages, installation instructions and head pressure control valve chart. (16 pp.)
AIA file no. 30-F-3

MFR: EDWARDS ENGINEERING CORP.
**Circle 132**

### Packaged air conditioners

Illustrated brochure describes design and construction features of line of packaged air conditioners. Capacities and physical data are presented in tabular form covering both air-cooled and water-cooled designs. (8 pp.)
AIA file no. 30-F

MFR: AMERICAN-STANDARD INDUSTRIAL DIV.
**Circle 133**

### Heating manual

*Pocket Manual on Heating* has been reprinted, including sections on wet heating systems, radiation, unit heaters, pumps, specialties, control equipment, engineered radiation, blower unit heaters, special purpose pumps and engineering data. Price is $1.00.
AIA file no. 30

MFR: DUNHAM-BUSH, INC.
**Circle 134**

### Steel boiler

Recent literature describes *TP Series, Three-Pass* steel heating boiler for large structures. Units, constructed to ASME specifications, feature rear cleanout door for cleaning firebox tubes. Available in 16 sizes. (4 pp.)
AIA file no. 30-C-1

MFR: PORTMAR BOILER CO., INC.
**Circle 135**

### Remote room conditioners

Catalog no. 381A gives dimensions, drawings and capacity data on line of remote room conditioners. Smaller cabinet models are available in 200, 300, 400 and 600 cfm, for use with both heating and cooling coils. (4 pp.)
AIA file no. 30-F-1

MFR: ACME INDUSTRIES, INC.
**Circle 136**

### Temperature controls

Bulletin GEA-6972 describes two temperature controls, 3ART-5, for domestic and commercial refrigeration systems, and 3ART-15, for room air conditioners. Publication includes pictures, features, dimensions, ratings and figures of temperature tolerances. (2 pp.)
AIA file no. 30-E

MFR: GENERAL ELECTRIC CO.
**Circle 137**

### AC systems

Bulletin is offered describing system-engineered components. Capacities, dimensions, heat transfer data and other engineering information are presented on shell and tube condensers, shell and coil condensers, small capacity water chillers, heat exchangers, oil separators, liquid receivers, and vertical and coil condensers. (8 pp.)
AIA file no. 30-F

MFR: ACME INDUSTRIES, INC.
**Circle 138**

### Electric boiler

Description of electric hot water heating boiler is furnished in current pamphlet. Suitable for use with any type hot water heating; can be used with water chiller for air conditioning. (4 pp.)
AIA file no. 30-C-1

MFR: PRECISION PARTS CORP.
**Circle 139**

## DOORS

### Commercial overhead doors

*Pacemaker* commercial and industrial overhead doors are illustrated in recent bulletin. Available in 6′ 4″ to 16′ 3″ widths, doors feature heavy gauge zinc plated tracks, hinges and hardware, cantilever type support brackets, optional panel arrangements, precision counterbalance, etc., as standard. (4 pp.)
AIA file no. 16-D

MFR: MCKEE DOOR CO.
**Circle 140**

### Decorative doors

Brochure presents features of line of flush, decorative doors. Available in aluminum, colored vinyl on steel and core wood, *Decor Dor* line is supplied in standard types and sizes. (4 pp.)
AIA file no. 16

MFR: DUSING AND HUNT, INC.
**Circle 141**

### Hollow metal doors

Hollow metal doors with matching frames and hardware are described in current brochure. Featured is *Medallion*, seamless, welded hollow metal door. Also included are flush and panel designs, louvered doors, transom frames, side lights and borrowed lights. Locksets, hinges, bolts, closers, etc., are illustrated. (32 pp.)
AIA file no. 16-A

MFR: CECO STEEL PRODUCTS CORP.
**Circle 142**

## WALLS

### Versatile wall panels

Do-it-yourself booklet describes *Panelok* wall system, system of woodgrained hardboard panels, steel splines and variety of fixtures. Instructions are given for changing wall hung desks, cabinets, etc. Closet guide chart shows how to increase storage capacity up to 50 per cent. Of interest to retailers. (12 pp.)
AIA file no. 23-L

MFR: MASONITE CORP.
**Circle 143**

### Partitions/movable walls

Color, texture and flexibility are stressed in current brochure describing partitions and movable walls. Units have expandable metal molding which permits choice of any paneling material. Illustrations show installation procedures. (6 pp.)
AIA file no. 35-H-6

MFR: DECOR PRODUCTS, INC.
**Circle 144**

## PLASTICS

### Plastics handling

Information on machining, forming, finishing and joining of *Plexiglas* sheets and other acrylic shapes is presented in current booklet. Material's flexibility is shown through detail drawings and explicit instructions. Includes cutting, sawing, drilling, shaping, sanding and others. (20 pp.)
AIA file no. 26-A-9

MFR: CADILLAC PLASTIC & CHEMICAL CO.
**Circle 145**

### Plastics list

Bulletin no. D400 contains general data on properties and uses of thermosetting phenolic and diallyl phthalate molding compounds, fire resistant *Hetron*® polyester resins for reinforced plastics and phenolic resins for bonding and coating. Product application photos and chart of typical properties of *Hetron* resins are included. (8 pp.)
AIA file no. 24

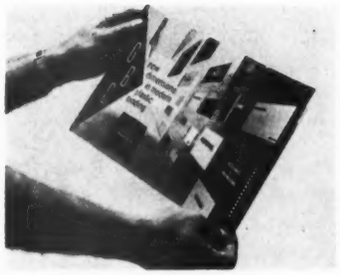
MFR: DUREZ PLASTICS DIV. HOOKER CHEMICAL CORP.
**Circle 146**

## MISCELLANY

### Plastic binding systems

*New Dimensions in Modern Plastic Binding*, describes plastic binding systems in office and plant business procedures. Systems can facilitate production of typewritten materials, booklets, reports, technical data and catalogs. (14 pp.)
AIA file no. 35-H-4

MFR: GENERAL BINDING CORP.
**Circle 147**



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### Transformer catalog

Catalog describes redesigned line of *Boost and Buck* transformers, featuring wiring compartment connection taps to provide increasing line voltage 6.66, 10, 13.32, 20 or 26.64 per cent; or reducing line voltage 4.75, 6.25, 9.1, 10 or 11.8 per cent. Charts show KVA capacity of transformers at various voltage connections, with a direct reference to size of transformer necessary for application. (6 pp.)
AIA file no. 31-B

MFR: ACME ELECTRIC CORP.
**Circle 148**

148

### Lighting standards

Indexed catalog of *Weldforged* lighting standards is available. Sections are devoted to steel and aluminum units. Covered are street and highway lighting, floodlighting, traffic signals, brackets, mast arms, etc. Data on *Classic* standard is provided. (72 pp.)
AIA file no. 31-F

MFR: KERRIGAN IRON WORKS, INC.
**Circle 149**

### Hardware catalog

Butt hinges, floor hinges, louver, lavatory door, screen door hardware and hinges, in varied designs and finishes, are covered in recent catalog. Installation information is included. (48 pp.)
AIA file no. 27-B

MFR: MILWAUKEE STAMPING CO.
**Circle 150**

### Raised chord designs

Series of typical designs for raised chord and scissor roof trusses are available, using *Teco* split ring system of construction. Spans range from 20' to 50' and spacings of 2' and 15' oc. Designs can accommodate wide variety of building requirements where raised or sloping ceiling effect is desired, e.g., churches and recreation halls. Stress diagrams, lumber and hardware requirements are provided. (8 designs)
AIA file no. 19-B-3

149

MFR: TIMBER ENGINEERING CO.
**Circle 151**

### Square urns

Recent bulletin describes combination units in line of *Square-Low* coffee urns. Stainless steel bottoms and sides are fused into one piece. Dimensions are provided in drawings. (2 pp.)
AIA file no. 35-C-3

MFR: S. BLICKMAN, INC.
**Circle 152**

### Pool equipment catalog

Catalog and price list is offered for line of pool equipment and accessories. List covers 64 product categories, weights and shipping information. (17 pp.)
AIA file no. 35-F-2

MFR: IMPERIAL POOL EQUIPMENT CO.
**Circle 153**

### Signaling equipment

Line of signaling equipment is illustrated and described in current catalog. Door chimes, fire alarms, bells, horns, transformers, contact devices, burglar alarms and annunciators are included. (36 pp.)
AIA file no. 31-i

MFR: EDWARDS CO., INC.
**Circle 154**

### Food handling

Recent brochure affords specifications and pertinent data on *Tri-Veyor* stainless steel for storing, transporting, heating and serving hot foods. Descriptions and instructions are provided. (8 pp.)
AIA file no. 35-C-13

MFR: SECO CO., INC.
**Circle 155**

### Bathroom cabinets

Catalog presents *Climax* line of bathroom cabinets and accessories. Models include sliding and swinging door wall surface cabinets, recessed cabinets and projection and recessed type accessories. Photos of all models are included. (8 pp.)
AIA file no. 29-J

MFR: MIAMI CABINET DIV., THE PHILIP CAREY MFG. CO.
**Circle 156**

### Floor maintenance/repair

Recent bulletin treats of *Emeri-Epox*, floor surfacing and patching material. Surface preparation, application materials and techniques and available colors are listed, with instructions for proper proportioning. (2 pp.)
AIA file no. 25-G

MFR: WALTER MAGUIRE CO., INC.
**Circle 157**

### Iron piping

Comprehensive booklet treats features of 4-D wrought iron pipe for building drainage systems. Material is corrosion and fatigue resistant, galvanized pipe. Booklet covers corrosive conditions, cost considerations, specification data and other allied information. (64 pp.)
AIA file no. 29-B-2

MFR: A. M. BYERS CO.
**Circle 158**

### Tile color guide

*Color Harmony Guide is Romany-Spartan* color palette showing 161 color hues and textures in line of ceramic glazed and natural clay tile. Literature is designed to facilitate harmonious blends or contrasts with variety of bath fixtures and wall tile colors. (4 pp.)
AIA file no. 23-A

MFR: UNITED STATES CERAMIC TILE CO.
**Circle 159**

### Aluminum conduit

Light weight, corrosion resistance, attractive appearance, nonmagnetic and nonsparking qualities and installation ease are attributed to aluminum rigid conduit in recent literature. Dimensions and weights of material are included, with applications. (6 pp.)
AIA file no. 31-C-62

MFR: ELECTRICAL CONDUCTOR DIV., KAISER ALUMINUM & CHEMICAL SALES, INC.
**Circle 160**

### Stainless steel uses

Summer issue of *Stainless Steel Architectural Quarterly* features use of stainless steel in store construction, and techniques for lighting stainless steel as a building material. Included are articles on design and fabrication of sun shields, and types and uses of stainless steel windows. (8 pp.)
AIA file no. 15-H-1

ASSN: COMMITTEE OF STAINLESS STEEL PRODUCERS, AMERICAN IRON AND STEEL INST.
**Circle 161**

**Modular Building Standards Assn.,** *2029 K. St., N. W., Washington 6, D. C.*

**Modular Dimensioning Practices,** *1959, 32 pp. $1.00.*
Proceedings of recent one-day symposium on modular measure.

**Modular Measure in Residential Construction,** *1959, 128 pp. $3.00/dozen.*
Covers modular design concepts, the general effects of modular practices, with broad coverage of current applications.

**Aluminum Company of America,** *789 Alcoa Building, Pittsburgh 19, Pa.*

**Alcoa Structural Handbook,** *Sixth Revision, 1959, 420 pp. $1.00; limited distribution at no charge.*
Current revision brings text and tables up-to-date, includes new tables, and extensive data on the aluminum-magnesium alloys, and comprehensive coverage of welded structure design.

**National Electrical Manufacturers Assn.,** *155 E. 44th St., New York 17, N. Y.*

**Protective Maintenance of Motors and Generators,** *1959, 63 pp. No charge.*
Intended primarily for maintenance men in the electrical industry but of interest to others concerned with motor and generator problems.

**Gas Turbine Power Plants,** *SM 30-1959, $1.00.*
Covers definitions, nomenclature, rating and performance, accessories, preparation for shipment and installation, and weather protection.

**Pressure Connectors for Copper Conductors,** *SG 8.1-1959 and SG 8.2-1959, 1959. $.30 each, per copy.*
SG 8.1 deals with compression-type connectors and SG 8.2 deals with screw-type connectors.

**NEMA Standards for Electrochemical Processing Semiconductor Rectifier Equipments,** *RI 6-1959, 1959, $.60.*
Encompasses conversion equipment utilizing semiconductor rectifying devices and complete with necessary transformer and essential control and protective apparatus, used as a d-c power supply for electrochemical processes. Covers definitions and general standards of service, design, performance and operation to be used as a basis for manufacture and use of equipment.

**NEMA Standards for Luminaire Head to Receive External, Locking Type Unit Control (Used in Street and Highway Lighting),** *SH 18-1959, 1959, $.25.*
Both EEI and NEMA have approved this suggested standard for future design which covers the means of control unit attachment to provide a rigid weatherproof electrical and physical junction of control unit and luminaire head.

**NEMA Standards for Industrial Laminated Thermosetting Products,** *LP 1-1959, 1959, $2.75.*
Describes colors, finishes, dimensions and tolerances, physical and electrical properties, and testing of various grades of industrial thermosetting laminates in the form of sheets, tubes or rods.

**NEMA Standards for High-temperature Properties of Industrial Thermosetting Laminates,** *LP 3-1959, 1959, $.30.*
Deals with effect of prolonged thermal exposure upon the mechanical and electrical properties of a number of representative NEMA grades of industrial thermosetting laminates.

**Large Generating and Converting Apparatus,** *LG 2-1959, 1959. $.30.*
Covers frequency and phase converters and large hydraulic-turbine-driven generators.

**Industrial Control,** *IC 1-1959, 1959. $6.00.*
Revised book covers the rating, test and performance, manufacturing and application of various types of control equipment.

**American Standards Assn.,** *70 E. 45th St., N. Y. 17, N. Y.*

**American Standard Illustrations for Publications and Projection,** Y15.1-1959, *published by American Society of Mechanical Engineers, 1959, 16 pp., $2.00.*
A new guide to help authors prepare clear and legible illustrations for technical papers and articles.

**Current Projects of the American Standards Association,** *1959, 52 pp. $.75.*
Describes a total of 425 American Standards projects including scope of each project, index and lists of sponsors.

**General Electric Co.,** *Ballast Department, 1430 East Fairchild, Danville, Ill.*

**Ballast Application Guidebook,** *GIZ-964, 1959, 100 pp. $5.00.*
Contains comprehensive information on the proper selection of fluorescent lamp ballasts. Periodic additions will be released.

**American Society for Testing Materials,** *1916 Race St., Philadelphia 3, Pa.*

**Symposium on Materials Research Frontiers,** *STP 243, 1959, 48 pp., $2.00.*
Prominent leaders in materials research discuss accomplishments that, in their respective fields, are helping to meet pressing challenges of the present rapidly changing technological era and will assist in preparing for the future.

**Man and Raw Mateials** *by Elmer Walter Pehrson, 1959, $1.25.*
Edgar Marburg Lecture delivered in 1958 at ASTM annual meeting. Mr. Pehrson discusses factors affecting raw material availability; geopolitical implications of raw material resources and production; and problems facing industrial nations in their access to raw material resources in backward areas of the world.

## FORECAST

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is a pourable variation which can be used for horizontal expansion joints. For a neat mechanic, clean up is no problem. In the wet condition there are numerous solvents that will remove the sealant. In the cured state, the best methods of removing it are with a razor blade or knife or by burning it off. Some mechanics prefer to soak it in a chlorinated solvent overnight.

"Where polysulfides are used in large quantities, as in a curtain wall fabricator's plant or on a large job in the field, equipment is available from equipment manufacturers and also from some of the producers of polysulfide sealants. There are generally two types of mixers. One type is a portable unit capable of mixing small quantities and filling cartridges on the job. We can highly recommend most of these pieces of equipment as they are now doing a fine job. Some caulkers and glaziers have developed a technique of pre-mixing and pre-freezing polysulfide sealants. This involves filling polyethylene cartridges with mixed material immediately after mixing. The cartridges then may be quick frozen in an acetone and dry ice bath before being placed in a freezer at 0°F. They can be kept in this fashion for several months. They may be removed at any time and allowed to thaw at room temperature for 15 to 30 minutes when the sealant again becomes liquid and may readily flow from a flow gun. The same principle may be used on a hot day to slow down the cure and give a longer working time with the mixed material. The frozen cartridges may be kept in a picnic cooler with dry ice and transported to the scaffold at the building site. In this way enough mixed material may be kept for an entire day's production when the temperature is at 90° or 100°F. With the new sealants on the market today, the actual work life after mixing is four to eight hours at normal temperatures which should be sufficient under most conditions."

**Silicone sealing materials** *by H. M. Johnson, Product Manager, Rubber Silicones Division, Union Carbide Corp.*

"Though discovered almost 50 years ago, silicones have been produced commercially for only slightly more than a decade. Silicones are entirely man-made —never found in nature. Basically, they are chemical combinations of silicon, oxygen, and organic chemicals. However, silicones are unlike any other group of chemicals, since they are neither organic nor inorganic, but rather are hybrids that inherit characteristics from both of these types. Thus they have properties altogether different from any other class of materials.

"Silicones are not entirely unknown in the building industry. Certain silicone resins are highly successful as masonry water repellents. Also, silicone rubber has been used in many applications where extremes of outdoor exposure have been encountered, although to date these have been non-building uses. Silicone rubber is compounded and fabricated in much the same way as organic rubber, but it is notably superior to its organic counterpart in the properties of high and low temperature stability and of oxidation resistance. With these facts in mind, this paper summarizes the advantages and disadvantages of silicone rubber for use in a new application—that of seals for exterior curtain walls.

"The primary concern in selecting suitable materials for seals in curtain wall construction is the effect of outdoor exposure. This exposure involves a number of environmental conditions which are considered separately in the following:

*Resistance to heat and cold:* Resistance to high temperature is probably the most utilized single property of silicone rubber. The service life of the rubber is measured in terms of weeks to months at temperatures in the 500-600° F range, while at 300-400° F the life is virtually unlimited. In normal outdoor exposure, it has been reported that temperatures in metal sheath structures might reach as high as 200° F. Such a temperature would not constitute even a reasonable test for the silicone structure. From the standpoint of flexibility under cold conditions, any silicone rubber compound would be satisfactory to temperatures as low as —65° F and special compounds are serviceable below —100° F. In this country, temperatures below 0° F are relatively uncommon, and are well above the temperature where silicones start initial hardening or stiffening to any significant degree. Unlike organic materials, the low temperature serviceability is achieved without use of plasticizers which may be extracted in contact with solvents or be lost during periods of high temperature service. High and low temperature properties are inherent in the silicone polymer.

*Resistance to oxidation:* Oxidation resistance of silicone compounds is outstanding. The service temperatures cited above, 300° F and 600° F, are exposures in air at these temperature extremes, which would greatly accelerate oxidation of any plastic or rubber material. In some industries, it is the practice to extrapolate accelerated aging data by attributing doubled effects for each 12° C rise in temperature. While this is undoubtedly open to some question on extreme extrapolations, the results are most interesting. Silicone rubber compounds will show measured losses in physical properties of 10 to 15 per cent in one-week exposure at 450° F. At 400° F similar losses should be found, by use of the 12° rule, in about sixty days. This agrees with actual measured losses as determined under laboratory conditions. A further extrapolation to 150° F would show a calculated life of over 60 years. Since this temperature is still quite high for an average in the contemplated uses, it could be concluded that the oxidation of the silicones would pose no problem.

*Resistance to ozone:* Small amounts of ozone in the atmosphere are one of the chief causes of rubber deterioration, particularly if the rubber is in a stressed condition. Resistance of silicone to attack by ozone is well documented and, as an example of this extreme resistance, a stressed silicone rubber hose was used to conduct a stream of 3 per cent ozone in oxygen for a period of seven hours. This ozone concentration represents the almost ridiculous extreme of 4.5 million times the normal atmospheric concentration. The silicones retained 70 per cent of original tensile strength, while most organic rubbers would have failed under these conditions in a matter of seconds. Tests at lower concentrations confirm that silicone rubber, without use of additives, is stable in the presence of ozone.

*Resistance to peroxides:* In the studies of ozone concentrations, some of the attack on rubber is attributed to the formation of organic peroxides, perhaps generated by reaction of ozone with traces of organic vapor in the air. Peroxides are especially prevalent in industrial areas and in high population areas. Although organic peroxides are used to cure silicone rubber, these are effective only when well dispersed at relatively high concentrations and at relatively high temperatures, usually greater than 240° F. Even under these drastic curing conditions, the oxidation resistance of silicones is such that only about 20 per cent of the peroxide is effective. As a further illustration, only certain species of peroxides will react with the silicones, even at elevated temperatures, to a sufficient degree to effect a cure. The kinds of peroxides generated in the atmosphere, at most, would be effective only on the vinyl groups in rubber, and these are consumed in the original curing reaction. As an example, a use for silicone rubber is in the manufacture of hose for handling 90 per cent hydrogen peroxide. After one week of exposure to this extreme peroxide concentration, there is virtually no change in flexibility in the silicone rubber and a negligible weight loss. On the basis of this test, silicone rubber is one of the few plastic materials deemed satisfactory for service in contact with high concentrations of hydrogen peroxide.

*Resistance to water:* Moisture resistance of silicone rubber is generally excellent. The choice of filler is important, but with

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the proper compounding, silicone rubber will absorb less than 1 per cent water during 168 hours of boiling-water exposure and retains over 90 per cent of original properties in the wet condition. Many electrical uses depend on this water resistance. Even compounds absorbing water up to 3 to 5 per cent by weight show only minor changes in properties when wet and are restored to original condition on drying.

*Resistance to ultraviolet light:* No test results are available where ultraviolet light was evaluated by itself for effects on silicone rubber. However, in both simulated tests and in actual outdoor exposures where ultraviolet light is known to be a factor, the negligible effects on silicone rubber properties would lead us to conclude that ultraviolet does not present a problem.

"Silicone rubber compounds are available in a variety of extruded and molded shapes. Virtually any shape is available, if a like shape could be manufactured from organic rubber or from plastic. Fabricators throughout the country are very familiar with the handling and fabrication of silicone compounds by extrusion. It is this technique which would most likely be used to produce curtain wall seals. Also available are plastic compounds in consistencies suitable for gun or knife application. These compounds are generally intended for uses where cure or vulcanization is not desired, and resist hardening or cracking even when exposed to high temperatures. Although relatively new, two-part silicone systems supplied in various consistencies from pourable to plastic, and which vulcanize at ambient temperatures, are now being marketed. These latter compounds are relatively new compared to the heat-cured, peroxide-catalyzed systems, but may be shown at some future date to retain the majority of the properties of the more conventional silicone compounds. No difficulties in procurement of any quantities of these material are foreseen.

"Compared to organic materials, silicone compounds have the disadvantage of relatively high initial cost. This cost has been reduced over the past few years but still remains at approximately four to five times that of organic rubber compounds. Therefore, the potential user will usually base his choice of a silicone material on its ability to do a job which cannot be done with less expensive materials. The higher initial cost in these applications is justified on the basis that no other material will perform for even short periods of time. A second consideration, however, is maintenance, where the initial cost may be counterbalanced by a savings in replacement of maintenance through the years of service. Even in the penny conscious automotive field, silicone compounds are used as oil seals at higher initial cost which, in turn, effects two savings, one in reducing the over-all cost of a unit by simplifying its construction and, the other, by greatly reducing service costs by increasing service life.

"The second limitation on the use of silicone compounds lies in their abrasion resistance and tear strength properties. While comparison with organic compounds is not always indicative, it can be said that, at room temperature, silicone rubber compounds may have ½ to ⅓ the tensile strength of an organic rubber compound, with about the same relationship holding for tear strength. However, if the properties are measured at elevated temperatures, the converse may hold true. In most cases, the engineer can overcome these deficiencies by designing a suitable joint. Problems of assembly and handling to compensate for the particular physical properties of silicone rubber have been successfully solved in the aircraft industry where a multitude of seals must be both factory installed and field installed. If the excellent weathering properties of silicone are of use to the construction industry, it would then seem that these less desirable properties (which associate themselves largely with the assembly operation rather than the service life of the material) could be overcome.

"Another limitation of the silicone compounds is the difficulty in adhering silicone to silicone under field conditions. This is not particularly unique to silicone rubber materials and is another problem usually solved by the designer.

"Silicone rubber will cause no deterioration or discoloration on adjacent construction materials. These compounds are normally colored by inorganic pigments which will not bleed or leech. The colors are quite stable to light, as well as to extremes in temperature. The use of silicone rubber compounds in sealing pharmaceutical bottles, where non-extractability is of the utmost importance, is an indication of the negligible effect of silicones on other materials. Due to their inertness, silicones should be highly resistant, if not impervious, to attack from other materials. For example, the use of window cleansers or other maintenance chemicals on a building should have no effect upon the appearance or performance of silicone rubber sealing strips.

"From the over-all standpoint, the properties of silicone rubber should certainly make the compounds candidates for use in curtain wall construction. While it is realized that the construction industry favors testing of materials for periods of 20 years or more, in the case of the silicone industry the materials under consideration have not been known for this length of time. Despite this fact, applications related to the problems of construction are well known and account for large-volume usage of the same general type materials. For example, the gasketing used on home and industrial ovens is frequently made from silicone rubber. The initial cost is more than compensated by the increased service life and lower maintenance. There are even cases where seals for such doors have been completely unavailable until silicone extrusions were supplied for this use. These are primarily indoor applications, but large industrial ovens using a curtain wall construction might have silicone rubber gasketing not only on the doors but between the panels. Certain types of street lamps now use silicone rubber gaskets, where exposure to heat as well as weathering is a problem. This again is a case where the most expensive material for the job has proved to be the most economical. A further illustration of weathering properties of silicones is the use of silicone rubber in aircraft, where conditions may vary from extreme heat to extreme cold, where ultraviolet and ozone concentrations at high altitudes are considerably greater than those on the ground, and where the change from one extreme condition to another is exceptionally rapid. A number of the uses cited date back over five years.

"Whether the need for the properties of the silicone compounds is sufficiently great to justify the cost is a question which must be answered by the architect and those specifying materials. It is certainly indicated that silicone materials would be effective in the application."

**Polybutene and polyisobutylene in sealing compounds** by *Paul S. Sussenbach, Presstite Division, American-Marietta Co.*

*"Introduction:* Sealing compounds used in the building trade for many, many years were made from drying, semi-drying and alkyd modified drying oils. In fact they were modified types of putty. The art of compounding materials of this nature is very old. The sealers did a good job of sealing. Buildings were rigid structures, movements around openings such as doors and windows were small. New type of buildings, with large panels introduced many problems making the old sealers inadequate. About 1940, polybutene and polyisobutylenes came on the market. They found use in defense products during the war. After the war, these materials opened the door for *preformed* caulking beads and ribbons. They were the first raw materials that possessed non-drying and other physical properties required to give preformed beads and ribbons with package stability. They possessed sealing characteristics superior in many respects to the old oil base compounds. Since their introduction, compounders have made full use of their physical properties.

*"Description of base compounds:* Polybutenes are pale colored, chemically inert liquids of moderate to high viscosity and tackiness. They are composed of Alpha and Beta butenes and have mean molecular weight ranges from 300 to 2,000. Polybutenes consist of close-packed branched chain molecules which render them extraordinarily impermeable to gases. They are permanently fluid, non-drying and light stable. The electrical properties of polybutenes are good, all grades have extremely high resistivity and good dielectric strength. Polybutenes are soluble in benzene, ethyl ether, petroleum and coal tar distillates, chlorinated hydrocarbons, and some esters such as butyl acetate.

"The polyisobutylenes are rubber-like solids varying in hardness from a soft gum to a tough mass resembling uncured crepe rubber. They are made up of polymerized isobutylenes and have a molecular weight range of from 8,000 to 140,000. The longer chain molecules of the polyisobutylenes are closely packed and interlock more than do the molecules of the polybutenes. The polyisobutylenes are also light stable, non-oxidizing, non-curing and like the polybutenes do not become brittle at extremely low temperatures. These materials, like the polybutenes have terminal unsaturation only. The electrical properties are good, all grades having extremely high resistivity and good dielectric strength. Due to their rubber-like consistency, they are often more difficult to solvate than are the polybutenes. The polyisobutylenes are essentially compatible with the same materials as are the polybutenes.

"Polybutenes and polyisobutylenes can be compounded with many other resins, oils, fillers, pigments and solvents to give a wide range of sealing compounds which meet many sealing needs. They can be blended in many proportions to give physical properties not obtainable when they are used as a straight vehicle.

*"Properties and shapes:* Sealing compounds in which polybutenes, polyisobutylenes, and blends of these materials are used as vehicles, are being supplied to the building trade today in the following forms: (1) gun grade caulking or sealing compounds; (2) knife grade caulking or sealing compounds; (3) preformed beads or ribbons; and (4) preformed reinforced beads or ribbons.

"Now that we have broken these sealing materials down into four basic forms or shapes, we shall endeavor to set forth some of the individual properties of each type of material. These materials were designed for different end uses and different application techniques. A proper understanding of the properties and limitations of each of these materials is necessary for matching the sealer to the joint to be sealed.

"The gun grade of pumpable caulking

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# ARCHITECTURAL USE OF PORCELAIN ENAMEL ON ALUMINUM

*by Richard M. Sherwood*
*Development Engineer*
*Aluminum Company of America*

With the trend to the use of more exterior color in architectural design today, porcelain enamel is rapidly becoming one of the most popular finishes for metal-clad buildings. Probably the fastest growing use of this versatile coating has been its use on aluminum.

## Definition

The basic definition of porcelain enamel on aluminum is "an inorganic glass bonded to aluminum by fusion about 800° F." For the architect who is specifying this finish, it becomes much more than that. He must take into consideration permanent color, shapes, texture, radical changes in temperature, impact loads and dead weights. It has only been since World War II that research and applications have proved porcelain enamel on aluminum's ability to fulfill all these requirements. For the aluminum-sheathed buildings, porcelain enamel on aluminum is competitive in costs with other color finishes now being used on the light metal.

Active research on porcelain for aluminum began in 1929 at the Alcoa Research Laboratories, but it was not until 1946 that special enamels were developed for this application. These new enamels, unlike existing formulations, can be fired at temperatures under 1000° F. The actual bonding of these enamels to aluminum has also been perfected for several special alloys.

Since Alcoa does not manufacture porcelain enamel on aluminum for the building industry, all of its research and development has been transmitted to private enameling companies who specialize in this type work. Primary consideration has been given to new alloys and surface treatments, evaluation of the weathering characteristics of enameled surfaces, and color retention of the finish. These developments, and subsequent applications, have shown that production enameling can be accomplished with excellent results at a minimum loss of material due to failure of the finish.

In order to reduce the number of rejections at the enamelers' plants, Alcoa has developed special alloys where composition limits are carefully controlled to reduce the possibility of spalling. These new alloys, approved and recommended by the *Porcelain Enamel Institute*, are named Alcoa Number One Porcelain Enameling Sheet and Extruded Shapes, and Number Three Porcelain Enameling Sheet. Rejections, due to failure by spalling from such specially developed alloys, occur less than one per cent of the time if proper enameling procedures are followed. With other aluminum alloys, rejections due to spalling may be much higher.

With special alloys and enamels available, interest in the use of porcelain enamel on aluminum has increased rapidly during the last few years, and this interest is expected to continue.

Porcelain enamel has certain individual characteristics found in no other finish, which should be thoroughly understood by the designer, so that he may take full use of their advantages.

## Color

A full range of lightfast colors is available for porcelain enamel on aluminum. In production lots, color match does not become a problem. Pigments, which are added to the clear enamel, are inorganic compounds, so colors are highly permanent. As a wide variety of inorganic oxides is available for use as pigment, a wide color range, with very good permanence, is available. Stable white or black pigments may be added to give all the light and dark hues of the various colors.

Extensive outdoor exposure test programs have been maintained for many years to check pigmented porcelain enamels.

## Texture

Architects concerned with brightness, flatness, image reflections and other characteristics of flat panels for curtain walls will find that texture can help to control these properties.

One of the most important methods of obtaining texture on porcelain enamel is by controlling the degree of gloss of the finish. The usual technique of reducing gloss is to add matting agents to the enamel. By this method, low to high gloss is obtainable.

Texture, as well as decorative and special effects, can be added by other means. Two-tone colors may be sprayed through stencils or applied by the silk screen process. Roller coating of the flat panels with special rollers can give unusual effects. Spatter may be applied with a spray gun using heavy, viscous enamel. High gloss enamels may be used in the above technique. Because the basic texture is rough, the final surface appears matte in spite of the enamel's high gloss.

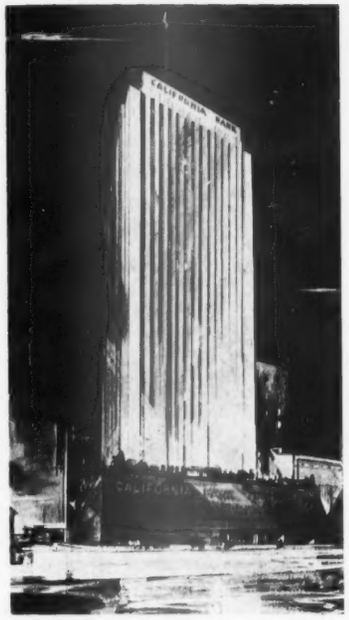
Pattern sheet without sharp changes of direction may also be used as a basis for textured porcelain enamel finishes. Forming after enameling is also a common way to obtain shadows and textures.

Most of the surface preparations commonly used when aluminum is anodized have little application in porcelain enamel work, as the majority of these pretreatments are hidden by the enamel. An etch, for example, does not show through the enamel coating.

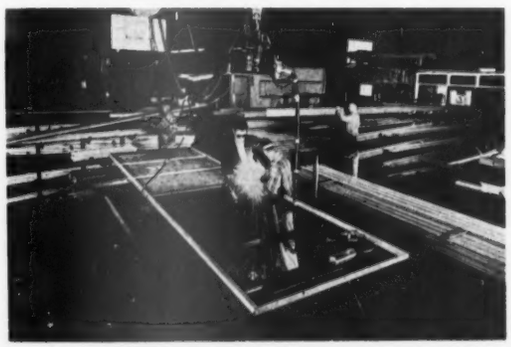
## Mechanical characteristics

One of the most important characteristics of porcelain enamel on aluminum is its tight bond with the base metal. This bond is so great that resistance to impact is excellent. While severe impacts on the porcelain finish may dent the aluminum and craze the surface, the enamel almost always retains its bond, with no progressive spalling and weathering of the metal. Because of aluminum's inherent resistance to corrosive atmospheres, there will be no build-up of colored corrosion on the exposed metal, hence no staining of the enameled panel.

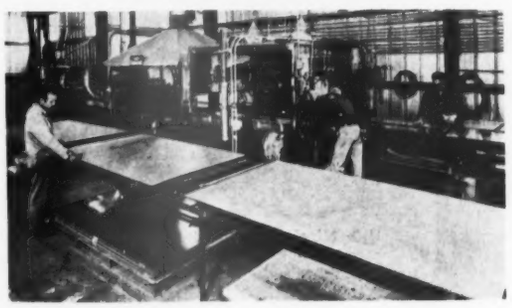
Dimensional changes of enameled aluminum due to thermal expansion and contraction have no detrimental effect on the coating. Expansion does



Opaque aluminum panels finished with charcoal gray porcelain enamel, will distinguish new California Bank Building in downtown Los Angeles. New 18-story structure marks first building exceeding 13 stories to be erected in Los Angeles since repeal of height limit restriction in 1956. Architects: Claud Beelman, AIA, and Associates.



Fabrication of aluminum wall panels for new California Bank building being handled above. In background is portion of aluminum extrusions which will frame each of 700 panels to be used on structure. Photo below shows porcelain enamel being applied to panels in shop.



not crack the coating nor does contraction tend to spall it from the base metal. Porcelain enamel on aluminum used in architectural applications requires the same provisions for expansion and contraction that are normally made for bare or anodized aluminum. It also has excellent resistance to dimensional changes from heat. Panels have been subjected to 1200° F. with no damage. This is partially due to the ability of the aluminum to conduct heat over the entire face of the panel, hence lowering the temperature at any one point.

## Fabrication and joining

A unique characteristic of porcelain enamel aluminum is that it can be fabricated after firing. No special skill is necessary to fabricate aluminum. Drilling, sawing, punching, shearing and welding operations may be carried out after enameling. Exposure of the base metal, inevitable in such fabrication techniques, will not result in undue corrosion. This is an exceedingly desirable characteristic as such exposure of the metal usually occurs at a highly stressed position, such as where the enamel part is bolted to a frame. Corrosion at such a location is particularly undesirable, as failure may not be merely unattractive, but also dangerous.

All standard welding techniques may be used on bare portions of enameled aluminum and procedures are similar to those used when unfinished aluminum is welded. The bare portion may also be brazed or soldered after the part has been enameled.

## Resistance to weathering

For the past 13 years, Alcoa Research Laboratories has collected much data through a continuing investigation into the weathering characteristic of porcelain enamel on aluminum. Several accelerated tests have been developed that have proved a good correlation between these tests and actual exterior exposure. In particular, an acid solubility test, adopted by the *Porcelain Enamel Institute*, can help to predict the weatherability of porcelain enamel.

## Cleaning and maintenance

Porcelain enamel is an easy finish to clean and maintain. Cleaning and maintenance, if desired, can usually be accomplished with soap and water. In addition, excessive collection of dirt can be avoided by proper design. Members should be designed so that dirt cannot accumulate on horizontal surfaces, and so all surfaces are cleaned by the washing action of rain. Medium and medium-high gloss formulations tend to have better self-cleaning properties and weather resistance than do the low gloss matte formulations.

## Quality control and specifications

As with any material to be used in architecture, mistakes can be made in processing porcelain enamel on aluminum. Rigid specifications and quality control tests, therefore, are necessary. To insure a good job, certain quality control tests should be a part of the specification. These are discussed below.

An ammonium chloride test determines the spall resistance of porcelain enamel on aluminum. This accelerated test is primarily intended to determine the strength of the bond between the enamel and the metal when exposed to the action of weathering or moisture. Since spalling may be caused by applications of the porcelain enamel to the wrong alloys, by improper pretreatment of the metal surface, or by improper processing conditions such as firing temperatures or enamel formulation, this test is extremely important.

The thickness of the porcelain enamel coating on exposed surfaces should be from .0025-inches to .005-inches after firing. The method for measuring the thickness of the coating is essentially that used to measure anodized coatings on aluminum, and involves measuring the electrical insulating capacity of the coating. In this test, as in any other quality control test, it is, of course, assumed that samples are taken from production material being enameled at the same time.

In order to insure proper formulation for color permanence, the porcelain enamel surface should not show objectionable discoloration or fading after artificial weathering agreed upon by the contracting parties. Such artificial weathering might consist of accelerated exposure in a "Fadometer" or "Sunshine Arc Weatherometer."

A gloss lower than 35 should not be used; instead, texture should be employed to simulate the appearance of matte surfaces. The gloss measurement used is a 45 degree luminous directional reflectance. The allowable range of gloss readings should be agreed upon by the enameler and the architect.

## Conclusion

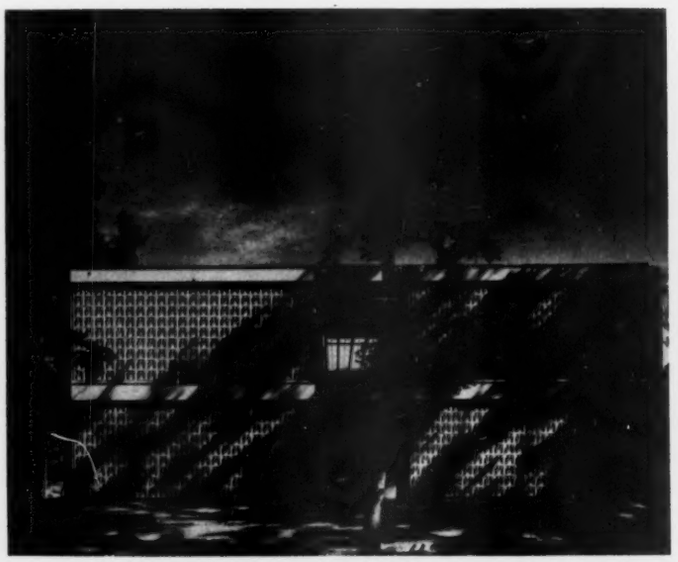
The basic properties of porcelain enamel applied to aluminum and basic quality control techniques that may be noted in architectural specifications have been discussed. As has been noted, the application of porcelain enamels to a highly corrosion-resistant base results in a product that has unusual characteristics. Most important of these characteristics is the inherent corrosion resistance of the base metal, which protects installations from failure following impact, or fabrication techniques which break the enamel surface. Because of this corrosion resistance, advanced forming techniques may be used which free the designer from the necessity of protecting sheared edges, punched holes, and the critical locations where the enameled part is fastened to the building. No staining of the panel will occur because of corrosion.

With good mechanical properties, with a wide range of lightfast colors, and with texture possible by using both porcelain enameling techniques and the fabrication possibilities available in the roll-pattern sheet and extrusion processes, the designer may free his imagination, concentrating upon the visual and functional aspects of the building without the necessity for detailing safe guards to protect the materials that he may use. Such freedom of design is becoming increasingly more apparent in American buildings today.

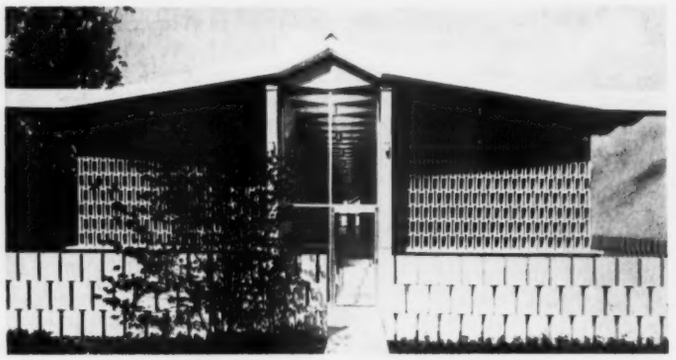
# PICTORIAL REVIEW OF CURTAIN WALL SYSTEMS

*Various types of curtain wall systems demonstrating a wide range of materials in their assembly are given in the brief pictorial survey which follows. Precast units, stainless steel, aluminum, bronze, glass, ceramics, mosaics, plastics, marble, limestone, porcelain enamels, composition panels—each material is finding its use as a protective skin in structures of recent years. Manufacturers of proprietary systems are mentioned in some items of this survey. This review is meant only as a sampling of some representative systems. A/E news reports all developments in curtain wall systems as they are made available by manufacturers and their representatives in our new products and literature departments in every issue of this publication.*

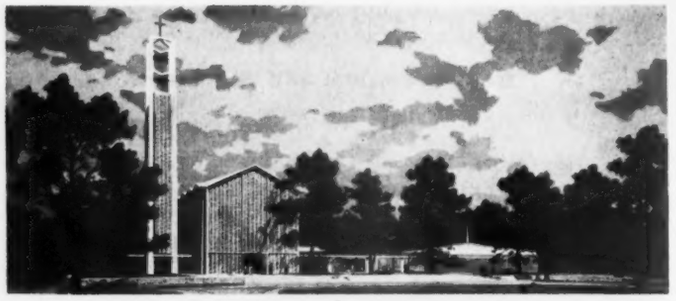




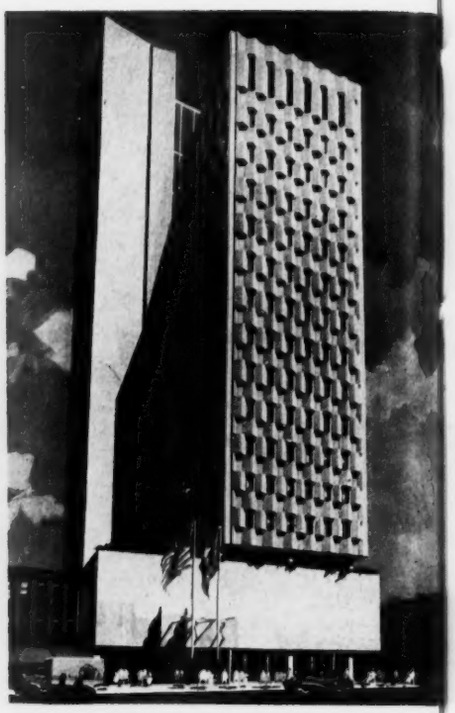
Recently opened Research and Engineering Laboratory, Sterling Forest at Tuxedo, N. Y. features curtain wall of precast dense concrete masonry units. Each block's interior face has clear glass sealed by pre-cut gasket applied with adhesive to both sides. Mortar setting is colored to match color block and contains waterproofing solution. Wide flange steel sections at corners and door frames secured by welding to structural framework. Plastic faced plywood horizontal facia expresses depth of construction which also incorporates duct work and lighting. Architects: Ives, Turano & Gardner, New York. (Photo: Lionel Freidman)



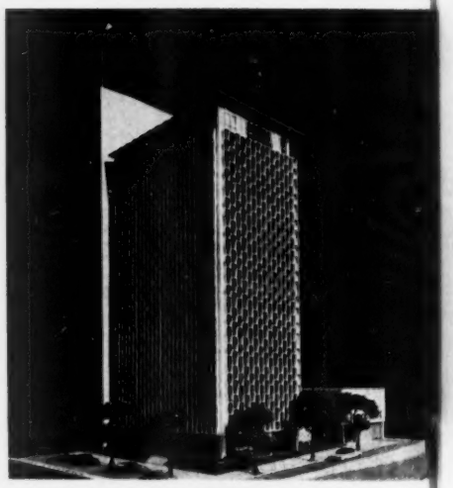
New headquarters building of the American Concrete Institute presents a delicate tracery in its pierced concrete block screen curtain walls. Folded plate roof cantilevers 19 feet from center corridor load-bearing walls. Designed by Minoru Yamasaki, AIA, Yamasaki, Leinweber and Associates, Architects and Engineers of Birmingham, Michigan.



St. Mark's Church in New Canaan, Conn., currently under construction, utilizes pre-cast units in an intricate curtain wall system or grille-work. Architects: Sherwood, Mills & Smith, Stamford, Conn.



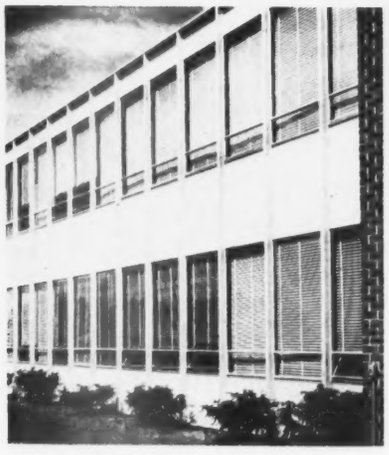
Recently-completed 15-story Wachovia Bank Building in Charlotte, N.C., is first tall building with a skin of precast concrete units. Prisms measuring 5½ feet wide, 6 feet high, and 2½" thick comprise most of building's face. Skin is fastened by lugs to the structural frame and aligned by series of 5" steel channel inserts. Building utilizes 3322 panels weighing 2000 lbs each. Architect: Harrison & Abramovitz, New York with A. G. Odell, Jr., and Associates, Charlotte, N.C. as associated architects.



U.S. Mission to the UN Building, now under construction features cast stone screen at the office wing. Curtain wall behind the stone screen consists of spandrel glass and pivoted windows which are made operable for the sole purpose of cleaning. The reinforced cast stone screen is of crushed quartz aggregate and white Portland cement. Compressive strength: 7500 psi; absorption factor: 5%; Waterproofing consists of two coats of silicone resin based colorless water repellent. Associated architects: Kelley & Gruzen—Kahn and Jacobs of New York; Structural engineers: Harwood & Gould, New York.

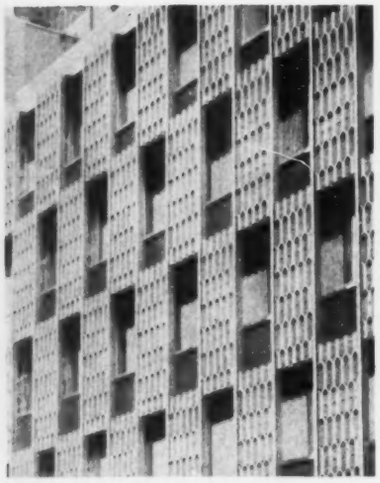
**PICTORIAL REVIEW:**
*asbestos type panels*

Incombustible, reinforced building panels of an inorganic asbestos with a permanent all mineral enameled surface are used as components of curtain wall system shown above. Recently introduced as "Glasweld," into this country by the U. S. Plywood Corp. the material has been used in Netherlands department store above. Architect: Prof. Putz, Heerlin, the Netherlands.

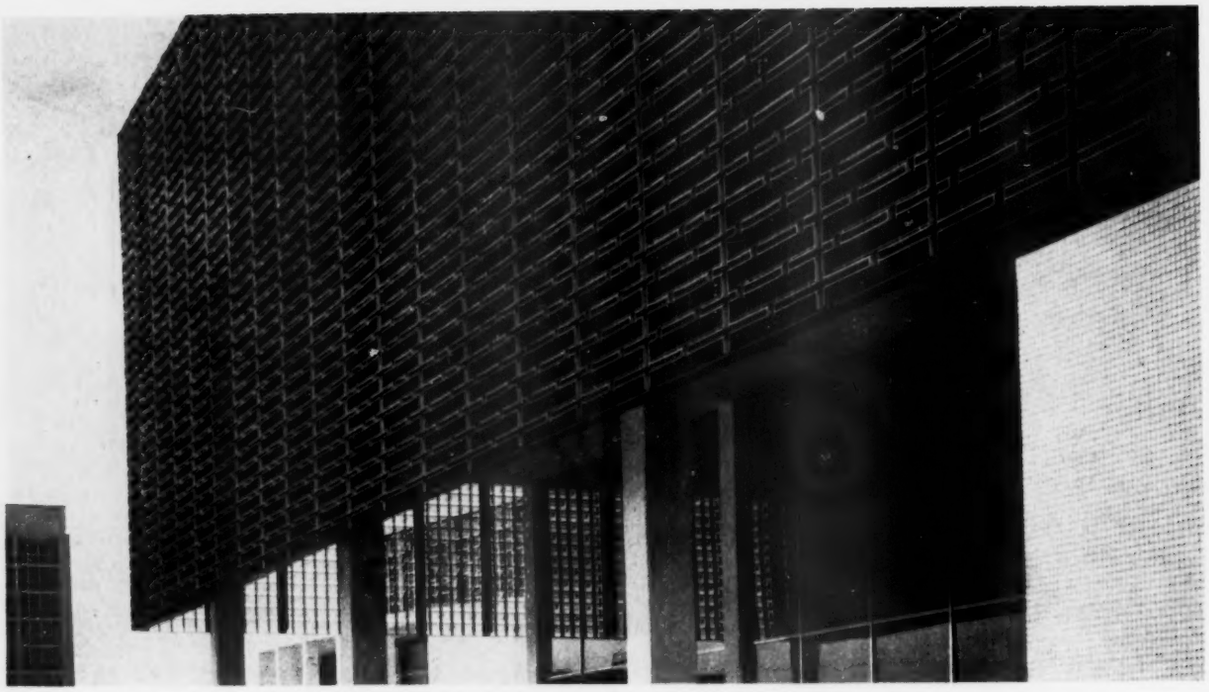


A fire-resistant panel for curtain wall assembly consists of two asbestos-cement sheets bonded with waterproof adhesive to each face of an asphalt-impregnated insulating core. Proprietary panel, "Insulpanel," is produced by the Keasbey & Mattison Co.

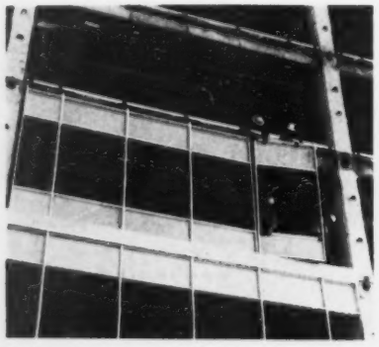
**PICTORIAL REVIEW:**
*aluminum wall systems*



Lightweight gold anodized aluminum grillwork, utilized decoratively and as solar-screen, on new Industrial National Bank of Miami. Architect: Edwin T. Reeder Associates, Miami, Fla.



An ornamental aluminum solar screen is part of the curtain wall system of the New Orleans Main Public Library. The screen consists of an aluminum egg-crate grid, 8 inches square by 6 inches deep, overlaid with intermediate fins on both its outer and inner sides. Architects: Curtis & Davis and Associated Architects and Engineers; Goldstein, Parham & Laboulsse, Architects; Favrot, Reed, Mathes & Bergman, Architects, New Orleans, La.



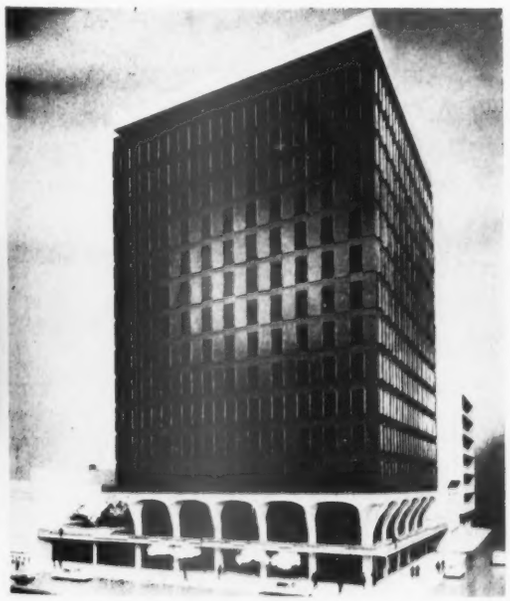
Kaiser Center Building at Oakland, California, currently under construction, shown being covered with a curved skin of gold anodized aluminum and tinted gray glass. Wall enclosed a 420-foot long, 390-foot high structural frame and will represent largest single application of aluminum in building. Spandrel panels and glass are divided into five-foot modules by extruded aluminum mullions and frame in 30-foot wide sections, with dark gray anodized column covers and natural finished beam facia. Framing outlines structure against spandrels and the two-foot wide column covers provide continuous definition of verticals. Sheet used for spandrels is ⅛" thick with a surface embossing. Complete spandrel is made up of gold alloy exterior sheet, lining of foil covered glass fiber insulation and flat aluminum ⅛" thick, 5005 alloy sheet. End walls faced with 5-foot wide, story-high dolomite faced blocks secured to the frame. Architects: Welton Becket and Associates, Los Angeles.

New $6.5 million sanitary flow treatment plant of Warren, Mich., uses gypsum-board core insulated aluminum curtain wall treatment. System, manufactured by R. C. Mahon, is offered in various gauge thicknesses and panel configurations. Panels are assembled on job with mechanical fasteners, and are U.L. rated for various fire-retarding capabilities.

P.S. 220 in New York (above) uses exterior skin (left) of aluminum structural mullions and gray aluminum spandrel panels. Framing is flat-slab concrete construction without additional spandrel beams. Wind loads transmitted directly to floor slab through simple clip fasteners at each aluminum structural mullion. Architects: Ballard, Todd and Snibbe of New York.

**PICTORIAL REVIEW:**
*bronze uses*

The well-known Seagram Building is the world's first bronze skyscraper using a system of bronze rails and panels in its 38-story high skin. Designed by Architects Miles van der Rohe and Philip Johnson with Kahn & Jacobs, Associated Architects.

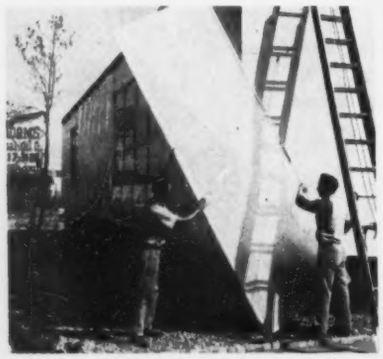


Model of the John Hancock Mutual Life Insurance Company's new home office building in San Francisco. Now under construction, this building will be the second largest commercial building of recent years to use bronze extensively as an exterior architectural metal. Panels are of polished dark gray granite with bronze framed window panels. Architects: Skidmore, Owings and Merrill.

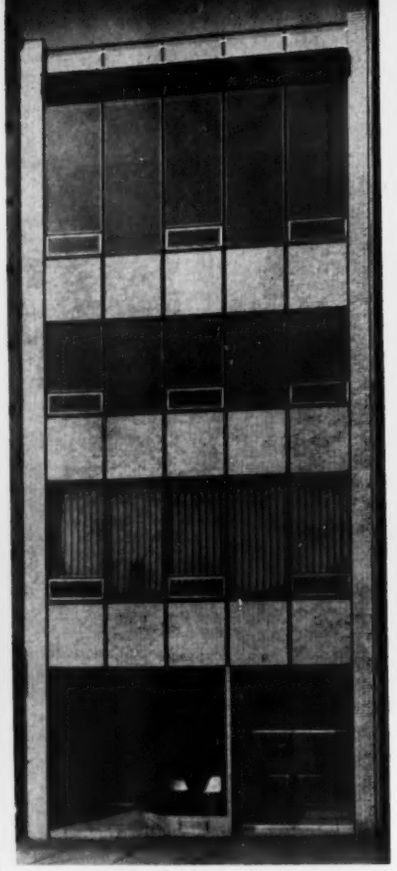
## PICTORIAL REVIEW:

*plastic wall systems*

System of plastic curtain wall panels, prefabricated by the Kalwall Corporation, are lightweight so that one man easily pushes the 14½ by 4 foot panel upright. Aluminum channels are ram-set to roof and floor locations before panels are placed.

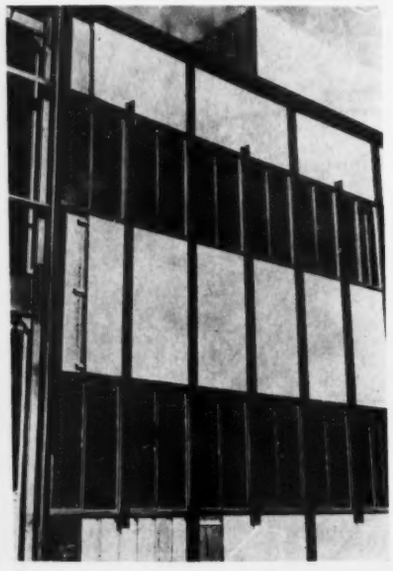


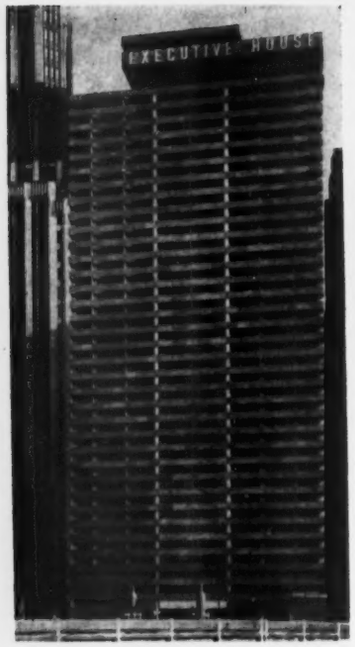
Twelve' high, cast acrylic panels (above) by the Wasco Products, Inc., are designed for exterior curtain walls. Three-dimension translucent sandwiches designed to provide structural qualities in curtain wall assembly by George R. Hermach of Eugene, Oregon.



Curtain wall utilizing structural steel "tees" for vertical definition in an assembly of glass and brick spandrel panels. Architect: Giorgio Cavaglieri, AIA, New York. (Photo: Berenice Abbot)

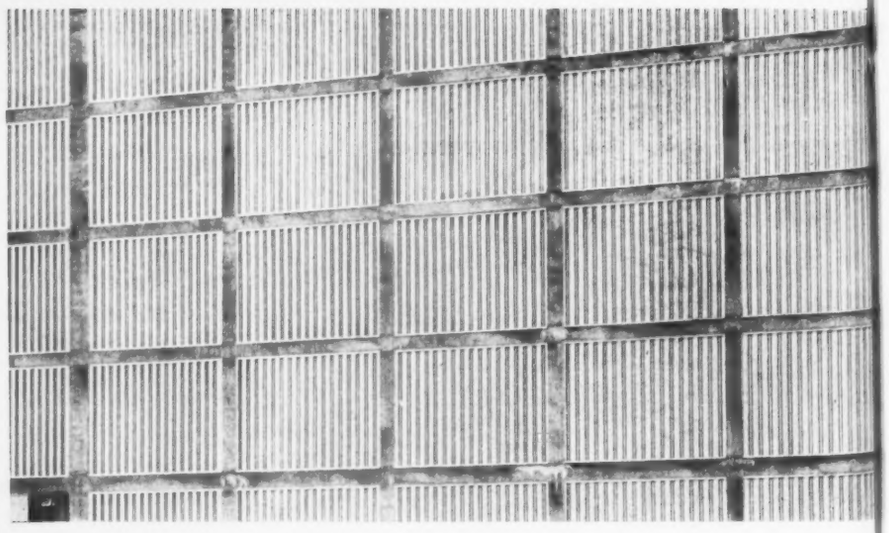
Functional architectural effect achieved by use of structural "tees" on four-foot centers on new research center buildings for Union Carbide Nuclear Company, near Tuxedo, N. Y. Stainless steel curtain wall panels are used in combination with the structural steel grid. "Tees" are cut from 12" lightweight structural beams. Lengths are fastened with adjustable clip bolts to intermediate "Z" bar and sill angle girts, positioned between the curb angle and facia plate.

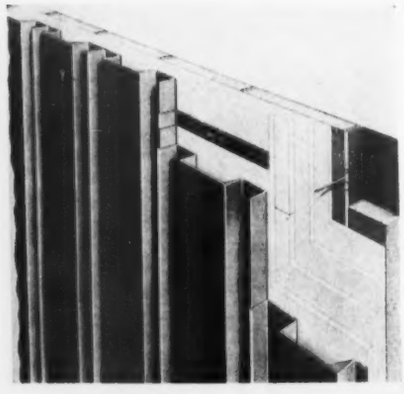





Thin, stainless steel 8' by 4' curtain wall panels serve as spandrels and guard rails for balcony areas of Chicago's new 40-story Executive House. Panel is composed of outer skin of 26-gauge stainless steel, an inner core of 1" cellular glass insulation and a 24-gauge galvanized steel back up sheet. Where panels are used on balconies, galvanized sheets are covered with white fiber-glass-reinforced polyester plastic. To comply with Chicago 3-hour fire rating, metal lath and sprayed vermiculite plaster were applied to panel backs in living areas. Architects: Milton M. Schwartz & Associates of Chicago.

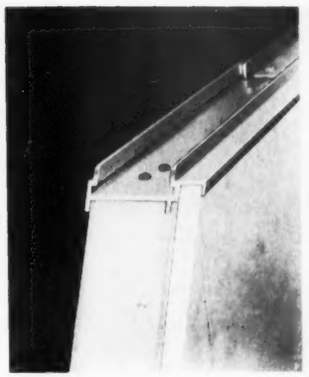
## PICTORIAL REVIEW: *stainless and other steels*





Stainless steel panels (above) used as skin enclosure in reinforced concrete structural frame for this plant. Part of proprietary system of fire-retarding curtain wall treatments (left) developed by R. C. Mahon Company. Heretofore, lightweight materials of this type were prohibited by codes. Now UL rated sandwich construction permits greater construction flexibility.

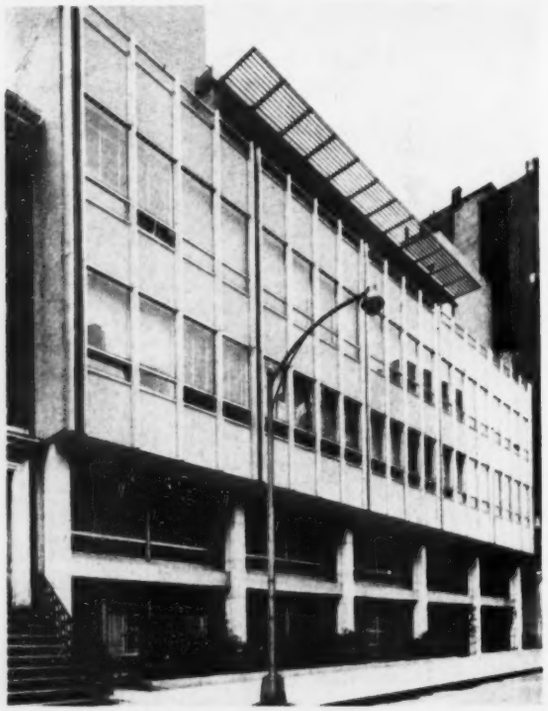
The just-completed Main Office of the National Bank of Detroit features a curtain wall system in a checkerboard pattern. The system consists of white Cherokee marble panels alternating with porcelain enamel on steel panels above and below the windows, with stainless steel framing members separating the individual panels. The window panels are backed with a ¼" insulating aluminum honeycomb. Behind the honeycomb is another sheet of steel which in turn is backed with a 2" thickness of insulating foamed glass. This is backed up with another sheet of heavy gauge steel to provide overall 2½" panel thickness. Architects: Albert Kahn Associated Architects and Engineers, Detroit.



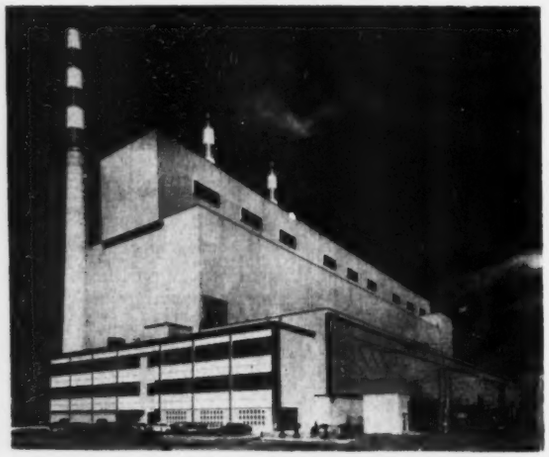
Proprietary marble curtain wall system, developed by the Vermont Marble Company, offers a pre-assembled modular curtain wall panel (right) measuring 4' x 5'. Twenty marble squares ½" thick and 1' square are permanently bonded to rigid insulation and exterior wall panel of cement board. Entire sandwich is mounted in extruded, anodized aluminum frame which fastens to adjoining panels with carefully detailed systems of tongue and groove members and vinyl sealer strips. (far right). Weight: less than 10¼ lbs/sf.

LIMESTONE IN CURTAIN WALLS was discussed recently by Jasper D. Ward of Louisville, Ky., architectural consultant to the Indiana Limestone Company, before the Society of Mining Engineers of the AIME. Ward reported the development by that company of an insulated, thin and comparatively lightweight panel suitable for use as a spandrel panel in curtain wall construction. The panel is described as being about 4" thick, and is composed of limestone backed with insulation. The inner surface of the insulation is backed with asbestos cement board or a metal pan, depending on the type of insulation, building code requirements and appearance (if the surface is left exposed.) The limestone is cut to the size of the spandrel openings and the insulation and back up is applied in the mill ready to be shipped and installed in the wall grid. A mortarless and waterproof joint with the metal frame components is achieved through the use of neoprene, polysulfide compounds and caulking. The limestone is "dirt-proofed" (waterproofed) in the mill to slow down discoloration.

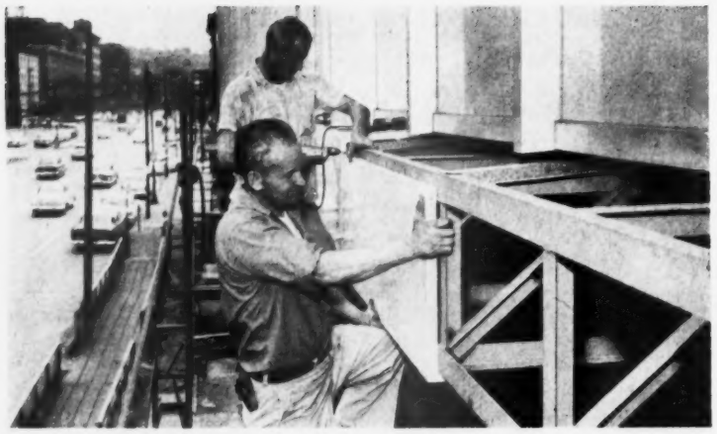
"Limestone, a traditionally sound material, can be used in this new way without losing any of its natural qualities of dimensional stability, resistance to fire and permance," said Mr. Ward. The assembly of the limestone and insulation can be made to custom design. Any good insulation can be used and the thickness of the stone varies from one and one-half inches for areas under twenty feet, to one and three-quarters inches for areas up to twenty feet.



Recently completed addition to the New School for Social Research in New York, features a curtain wall assembly of spandrel panels of porcelain enamel on 18 gauge steel bonded to approximately ¼" asbestos board panel and 24 gauge steel back up sheet. The panel contains 1" of air space and is not provided with other insulation. Vertical fins are of aluminum. Architects: Mayer, Whittlesey & Glass of New York.

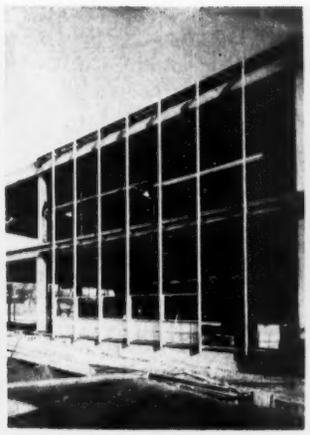


Newly completed generating station for Memphis, Tenn. is sheathed in more than 200,000 pounds of porcelain enamel on aluminum, ranging from insulated panels to specially designed grid-wall office sections. Main plant panels are 3½" thick, forming both the exterior and interior finish and have a glass fiber core. Architect: Office of Walk C. Jones, Jr., Memphis.



26-story Kroger Building of Cincinnati nears completion of installation of more than 7,500 porcelain enamel panels. This is believed to be largest number of porcelain enamel panels on any project to date. The panels consist of 16 gauge porcelain enameled steel, insulating core of 1½" glass fiber and back pan of 26 gauge galvanized steel. Weight: 4.5 psf; U-factor: .17. Panels are of semi-matte finish in light blue, dark blue and off-white colors. Architects: Hedrick and Stanley, Architects and Engineers, Fort Worth, Texas.

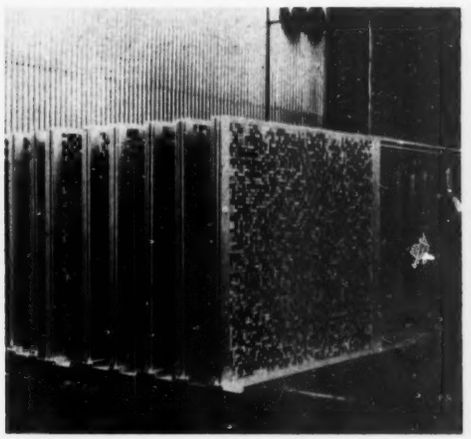
Proprietary porcelain enamel on steel curtain wall system, developed by Fenestra, is shown above. System offers steel grid units up to 30 feet in length and in widths to 8 feet. Cold rolled perimeter framing members are of 12 gauge zinc coated steel. Frames, vents and panels are pre-assembled at the plant.



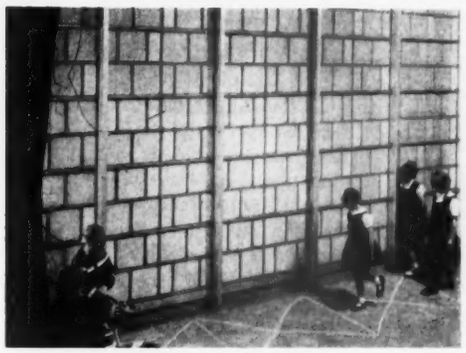
Architect's rendering of Farmington, Michigan Jr. High School (left). Building used 5,000 square feet of "Thinlite" proprietary curtain wall system developed by Owens-Illinois. Center photo shows system under construction extending from grade to roof. System designed to eliminate costly, on-the-job erection problems. Most accessories are extruded aluminum. Others are galvanized or stainless steel. All exposed are caustic etched and anodized. Shown right is stainless steel bolt and clip assembly used for attaching standard panels to aluminum struts. Extruded aluminum batten strips carry their own neoprene gaskets and self-locking nut and bolt assembly after panels have been bolted into place. Snap-on moldings to cover batten strip bolts are part of the assembly. Architects: Smith-Tarapata and MacMahon, Birmingham, Mich.

Corning Glass Works new 28-story skyscraper of glass in New York is stated to carry use of glass as an architectural material further than any other commercial building in existence today. Architects: Harrison and Abramovitz and Abbe of New York.

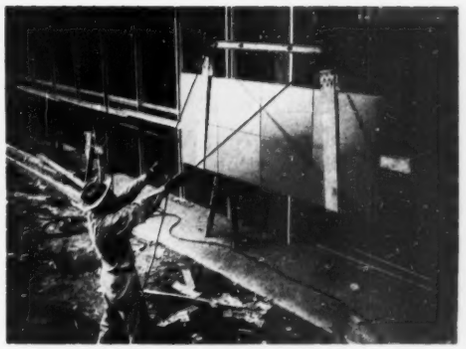
Curtain wall panels, faced with dark blue, gray and black ceramic tile, are used in Fuhrmann Junior High School of Warren, Mich. Proprietary system of curtain wall panels by the Maul Macotta Corp. Architects: Smith-Tarpata & MacMahon of Birmingham, Mich. (Photo: Hedrich-Blessing)



Aluminum sash with completed mosaic glass sections prepared for installation as exterior wall of the First National Bank of Portland, Oregon. In this type of curtain wall construction, aluminum framed wall sections are hung from the building frame, not set into it. Architects: Stanton, Boles, Maguire and Church of Portland.



Full scale "mock-up" of glass unit curtain wall assembly is shown above. Developments in system include rectangular, prismatic glass shapes and ceramic fired-on colors. Panels are composed of hollow glass tile, incorporating prismatic principle of solar selection.



Thin ceramic veneer curtain wall, development of recent years by the Structural Clay Products Institute, utilizes an adhesion type ceramic veneer from one to one and one-quarter inches thick. Method of lifting panel and its positioning are shown.

# communications

*A/E NEWS welcomes the opinions of its readers. Letters should be addressed to: Editor, Architectural and Engineering News, 452 Fifth Ave., N.Y. 18.*

Editor:

I was pleased to receive the first issue of your publication and noted the editorial covering the 1959 A.I.A. Convention.

Sometime perhaps you may be interested in doing an article on the Society of American Registered Architects, 622 Mortgage Guarantee Building, Atlanta 3, Georgia, which has chapters and members in 44 states. I believe it will also be of interest to your readers.

*Yours very truly,*
*Harry Allan Lucht, Architect*
*West Englewood, N. J.*

**Editor's note:** *In response to Mr. Lucht's suggestion, the editor wrote to the American Registered Architects, Inc., and received the subsequent reply to a series of standard questions, by Mr. Wilfred J. Gregson, National President of the ARA. The editor, in publishing Mr. Gregson's reply, does not necessarily associate himself with any of Mr. Gregson's comments.*

Dear Mr. Carlos:

A number of the members of A.R.A. have discussed your new "Architectural & Engineering News;" therefore I am very pleased to write to you in accordance with your request of July 2, 1959.

Our organization is "The Society of American Registered Architects," 622 Mortgage Guarantee Building, Atlanta 3, Georgia. Our telephone number is JAckson 5-0436.

Our main objective is to get all architects working together and organized so that they can operate as a body on any given item affecting the welfare of architecture. There is no such organization at present, as you know.

The objective also includes sufficient representation in the Federal Government as well as State Governments to see that architecture is upheld.

The membership is open to all registered architects. There are no bars or barriers. There are two types of membership—Registered Architect, and S.A.R.A., meaning student membership which includes students in college or attempting to get registered. Membership is approximately 1,000 at present.

We are enclosing our brochure which gives the names of all the officers and photographs of the National group. It also lists the elected officers of the chartered organization of the American Registered Architects of Kansas and a photograph of that group.

We have no public relations representative. Each architect is presumably representative.

We will be pleased to place A/E News on our press releases, etc.

and to give you any other information which we believe will be of value to you. Frankly, the architectural magazines have been pretty much under control of the A.I.A. group and apparently are afraid of running other than A.I.A. material. On this, I believe they have some reason to be careful as far as some supplementary materials are concerned.

A.R.A. is founded on the "Golden Rule." It was necessary in founding this organization to establish some basis acceptable to all, and, after a very long and profound search, it was discovered that the "Golden Rule" covered all points. We are trying to establish a better relationship between architects as well as others and the "Golden Rule" fits the bill.

After four years of functioning, it is interesting how very effective this has been. The unity that has grown in Kansas is something of which to be extremely proud. Kansas was the first to start an organized State group. We now have Texas as a Statewide group too. The effect on architects has been quite interesting. We have noted the growth of architects who belong to A.R.A. as well as the friendly relationship that has been established. These are only the fringe benefits. There are a great many others. For example, we are able to provide insurance for architects by group purchase at 40 per cent less than is possible through regular channels.

We also have other little advantages such as exchange of information from architect to architect as well as big benefits such as stopping the punitive laws which some groups of architects seem to feel is the answer to every problem. Of course, those architects seldom realize that the situation would be different if another group were in control. This is particularly true in Board control of the State and other control groups. If they are operated by a minority group of architects it is only a short time before this gets to be commercial and with that comes interior fights within the organization responsible.

As far as we can see, there is only one way to solve the whole problem and that is by having all architects work together. It is to that end that we are progressing, and we are extremely proud of what has been accomplished and very much alert to the fact that there are greater avenues of possibilities to which we will advance.

We will appreciate very much anything that you can get out in your publication and would appreciate hearing from you further.

Good luck to you on your magazine which, I am sure you will be delighted to know, has been discussed in Kansas and across the United States by our members.

*Sincerely,*
*American Registered Architects, Inc.*

*Wilfred J. Gregson*
*National President*



## THE MIGHTY FORCE OF RESEARCH

**Research in Architecture:** The *Mighty Force of Research* is the title of a book published by the McGraw-Hill Book Company in a series of editions over the past few years. The book, a compilation of a series of essays by the editors of *Fortune* magazine, dramatically tells the story of research and development in these United States over the past fifteen years. Expenditures for research have risen annually from about $900 million to a total of 7.2 billion in 1959 according to a recently released survey from the *National Science Foundation*. By-and-large, the overwhelming portion of this vast amount of money has gone into applied technological research and perhaps little more than five per cent of the total goes into what is considered "blue-sky" or experimental work aimed at expanding our basic or fundamental knowledges. Many authorities in the fields of education and science have deplored this apparent imbalance in research efforts. However, we are inclined to think that the implementation of much of our applied technological research ultimately raises new problems which find their solution in more basic research. Therefore—in use or application—the desired balance will occur.

In a dynamic and fluid society such as ours, there is room for the *spontaneous*—the "continuous reorganization of experience" as formulated by the great teacher and philosopher, John Dewey. When one examines the complete picture of both empirically and scientifically conditioned experiences, one may find that today's experience is not an exact duplicate of yesterday's experience. A process of reorganization has occurred in the re-application of sensation and knowledge. Accordingly, all scientific, that is, rational and objective exploration of our technology is a good thing. It is a continuing educational process. Like all things *educational*, it is inevitably a long, tedious and perhaps thankless process. However, the essential aim of all education, whether in architecture or engineering or just life, is the *improvability* of things. Therefore, all efforts at this improvability or growth—no matter how slow and seemingly prosaic—are to be encouraged and nourished.

It is with this thought in mind that we applaud the *AIA-National Science Foundation Conference on Research for Architecture* held at Ann Arbor, Michigan. The conference resulted from extensive preliminary explorations by the national AIA Committee on Research and the AIA Department of Education and Research. The National Science Foundation supported this research for the "fundamentals" or basic educational and planning tools on what would constitute "research" in architecture. This conference concerned itself with the concept of "total environment" and the role that architecture and the architect play in relation to it. This was an exploratory meeting in which definitions and the purposes of a research for architecture were discussed. We cannot stress too strongly the significance of this step by the AIA. This is a legitimate right and privilege of the profession—the integration and correlation of other educational and scientific disciplines with the historical aims of architecture as the source of the well being of a nation and a hallmark of its civilization. We urge every member of the architectural and allied professions to acquaint himself with this praiseworthy endeavor and give it interested support.

**Journal of Research:** The National Bureau of Standards has begun the publication of its *Journal of Research* which reports research and development in many fields of scientific and technical endeavor. The Journal is published in four separate sections. Of immediate interest to our readers would be Section C on Engineering and Instrumentation. This section reports research and development results of interest to the engineering and applied scientist. This excellent periodical is the latest addition to the NBS regular program of its non-periodical published series dealing with a variety of subjects of interest to both the architect and the engineer. Further information on the Journal of Research may be had from the National Bureau of Standards, U.S. Dept. of Commerce, Washington 25, D.C.

**School construction programs:** While on the subject of Federal publications, we would like to call the reader's attention to a noteworthy document of the *Office of Education* of the U.S. Department of Health, Education and Welfare. It is entitled, *Local School Construction Programs, Bulletin 1957 No. 20*, and is designed as a guide to procedural steps in local school building programming by interested communities. This excellent programming guide gives a wide range of information about the study and planning phases, the architect's services, building construction and equipment and methods of financing. The publication is carefully supplemented with 30 tables of bond-amortizing schedules. Although it's been around for a couple of years, it is worthy of consideration by school architects and belongs on the professional's reference shelf. This handy source of information is sold for fifty-five cents by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

*JJC*

# books

**The Architect's Estimator, 1959,** *compiled and edited by Jacques Ing Cramer Priest. Pasadena, Calif.: Professional Publishing Co. of Pasadena, 1959. 106 loose leaf pp. $35.00.*

Completely revised and all costs brought up-to-date. Periodic supplements and changes sent during year free of charge. Lists current building costs for every unit of any building project and provides tables and factors which may be used as short cuts in calculating quantities of material.

**Epoxy Resins** *by Irving Skeist. New York: Reinhold Publishing Corp., 1958. 293 pp., illus. $5.50.*

Contains resin intermediates, flexibilizing modifiers for epoxy resins, reinforcements, fillers, thixotropic agents, colorants, etc. Also treats new developments in epoxies; contains bibliography.

**The Structure of Metals; A Modern Conception.** *Lectures Delivered at the Institution of Metallurgist Refresher Course, 1958. New York: Interscience Publishers, Inc., 1959. 118 pp., illus. $4.00.*

Covers the electron structure of metals, experimental aspects of the electronic theory of metals, dislocations in metals and seeing dislocations.

**Advanced Structural Analysis** *by Sidney F. Borg and Joseph J. Gennaro. Princeton, N. J.: D. Van Nostrand Co., Inc., 1959. 368 pp., illus. $7.50.*

Of interest to practicing structural designers. Treats various methods for determining deflections and for solving statically indeterminate structures. Covers advanced topics such as, principles of slab and shell analysis, temperature analysis, numerical methods and electronic computer machines.

**Structural Design for Dynamic Loads** *by Charles H. Norris and others. New York: McGraw-Hill Book Co., Inc., 1959. 453 pp., illus. $12.50.*

Well illustrated and generally well documented survey of and guide to

# books

the field of structural design for dynamic loading. Not intended as a textbook or reference book.

**High Temperature Materials.** *Conference Held in Cleveland, Ohio, April 16-17, 1959, edited by R. F. Hehemann and G. Mervin Ault. New York: John Wiley & Sons, Inc., 1959. 544 pp., illus. $17.50.*

Presents 34 papers which discuss investigations of properties of various materials at temperatures of the order of 1,500° F and higher. Well illustrated with references for further study.

**American School and University,** *31st Annual Edition. New York: Buttenheim Publishing Corp., 1959. 156 pp. $10.00.*

Contains 156 pages of original research and 40 articles and several hundred catalog reference pages related to the design, construction, equipment, utilization and maintenance of educational buildings and grounds. Includes 130 separately indexed product categories from more than 1,000 manufacturers.

**Rehabilitation Center Planning —An Architectural Guide** *by F. Cuthbert Salmon, AIA, and Christine F. Salmon, AIA. University Park, Pa.: The Pennsylvania State University Press, 1959. 160 pp., illus., 32 pp. supplement. $12.50.*

Result of project sponsored by AIA and the Conference of Rehabilitation Centers conducted at The Pennsylvania State University.

**Machinery's Handbook,** *16th Edition. New York: The Industrial Press, 1959. 2,104 pp. $11.00.*

Handbook has been extensively revised to include latest changes in data and technology. Section on screw thread systems has been completely revised.

**Reinforced Concrete Fundamentals with Emphasis on Ultimate Strength** *by Phil M. Ferguson. New York: John Wiley & Sons, Inc., 1958. 604 pp., illus. $9.50.*

Reinforced concrete textbook, designed

*(Continued on page 58)*

# names

**Richard J. Neutra, FAIA**

Photo: Doris Dehn

**Here is a man—architect, city planner and humanist—who hardly needs an introduction to our readers.**

**It is quite difficult—if not impossible—to characterize the multi-faceted qualities of one of the world's foremost living architects—Richard J. Neutra. He cannot be measured by an single project. To grasp the intellectual and aesthetic dimensions of this architect and city planner of colleges, universities, museums, art collections, cultural centers, schools, housing projects, evokes a series of images—one superimposed upon the other.**

**In Neutra, one cannot separate *ideas* from design. There is a literary quality in each of his buildings—each is a subtle biography of its occupants and of the structure's ultimate function as a setting for human activity. Through his works—those of the design board and those of the written and spoken word, he has been a trend-setting pioneer and forerunner of our current aesthetic standards in buildings, in manufactured articles and in planning communities.**

**As an architect, he is not given to glittering generalities. Instead, he has demonstrated time and time again, the scientific basis of contemporary architectural aesthetics. His architecture and his books are living testament to his brilliant intellectual dissection of the physiological and neurological responses of the human being and of the architect's responsibility in creating an environment accurately reflecting emotional satisfactions of living.**

**Neutra has consistently championed the cause of his profession by stating the need for a broadened service in which our architecture will not be "satisfied to pose as sterile fabrication, nor as 'abstract art,' but rather become biologically concrete, and help to bring it forth into bud, bloom, and fruit of life as a lovely designed greenhouse, friendly to nature and close to her."**

**Universal recognition of 88 degrees, honorary memberships in professional organizations and international honors and awards have been bestowed upon Neutra by governments, universities, societies and professional groups of each of the five continents. Recently he received the *Order of Merit* of the Federal Republic of Germany presented to him on behalf of Prof. Theodor Heuss, President of the Bonn Republic. This high honor (Shown in Mr. Neutra's portrait) was given in recognition of Neutra's influence in "succeeding in harmoniously fusing nature and man-made technological attainments, without constrained adherence to inflexibile ideas, and as the master who, by his teachings, restored our faith in the deeper meaning of beauty."**

**Aside from his interest in technological organization and the aesthetic assembly of forms, materials and colors, Neutra's chief interest lies in the wide, endless natural landscape—an interest which absorbs all that one pair of human eyes may comprehend—from the starred, vaulted skies to the vast reaches of horizon down to the *minutiae* of nature's wondrous work—all serving as inspiration for Neutra's sensory and architectonic response to the complexities of the 20th century.**

**Neutra is the legitimate heir to the naturalism and empyrean spirit of Frank Lloyd Wright—in seeking the reconciliation of nature and the diversities of man-made environment.**

**Next year, on April 8th, Neutra will reach his 68th year. His faithful companion in over 38 years of pioneering struggle has been his wife, Dione. She has encouraged him in his slow ascent to his current international preeminence. One personal fulfillment for her has been in the naming of Lemoore, California's newest school building, the *Richard Neutra School.***

**The architectural profession of this nation may take justifiable pride in having this distinguished practitioner among its ranks. The American people, as a nation, is indeed fortunate in having among its citizens, an inspired and gifted human being who has contributed a life-time of creative work to the cultural riches and heritage of this country—*JJC***

# books

*(Continued from page 57)*

for undergraduate courses. Physical behavior of reinforced concrete members and the approved ultimate strength theory are covered.

**Bar Placement Manual** *prepared under direction of the Engineering Practice Committee, Concrete Reinforcing Steel Institute. Chicago: Concrete Reinforcing Steel Institute, 1959. 281 pp., illus. $3.00.*
Compendium of accepted current practices on concrete structures, reinforcing bars and bar placement. Well illustrated with photographs and detailed drawings.

**Graphical Communication; Drafting, Sketching and Blueprint Reading** *by Earl D. Black. New York: McGraw-Hill Book Co., Inc., 1959. 238 pp., illus. $8.00.*
Aimed at needs of engineering technicians in industrial drafting and designing rooms. Presentation is more simplified than that of usual college text in engineering drawing.

**Factors in Special Fire Risk Analysis** *by William Durant Milne. Philadelphia: Chilton Co., 1959. 165 pp. $10.00.*
Includes discussion of companies, fire itself, underwriting, construction, occupancy, exposure, public protection, automatic sprinkler protection, etc.

**Primer of Lamps and Lighting** *by Willard Allphin. Philadelphia: Chilton Co., 1959. 224 pp., with slide rule, illus. $10.00.*
Basic information on correct uses of lighting presented and also up-to-date information on currently available lamps.

**Water Facts for the Nation's Future; Uses and Benefits of Hydrologic Data Programs** *by Walter B. Langbein and William G. Hoyt. New York: The Ronald Press, Inc., 1959. 288 pp., illus. $5.00.*
A critical examination of the country's water resources and the problems and programs involved in them. Well documented work which was sponsored by the Conservation Foundation.

### films

**Behind the Red Diamond** *produced by Simpson Logging Co., Shelton, Wash., 1959. Color slide film, running time 20 min., available on loan basis.*
Depicts stages of producing and distributing forest products from forest to sales outlets.

**New Fastening Methods** *available through Huck Manufacturing Co., 2480 Bellevue Ave., Detroit 7, Mich., 1959. Color, 16 mm., running time 13 min., available on loan basis.*
Features *Huckbolt* fastener in many applications, including steel and aluminum buildings.

**On Deck** *available through Metal Roof Deck Technical Institute, 53 W. Jackson Blvd., Chicago 4, Ill., 1959. Color, sound, 16 mm., running time 15 min. Available free of charge.*
Shows how metal roof deck is designed and tested, and how it is applied in various kinds of new construction.

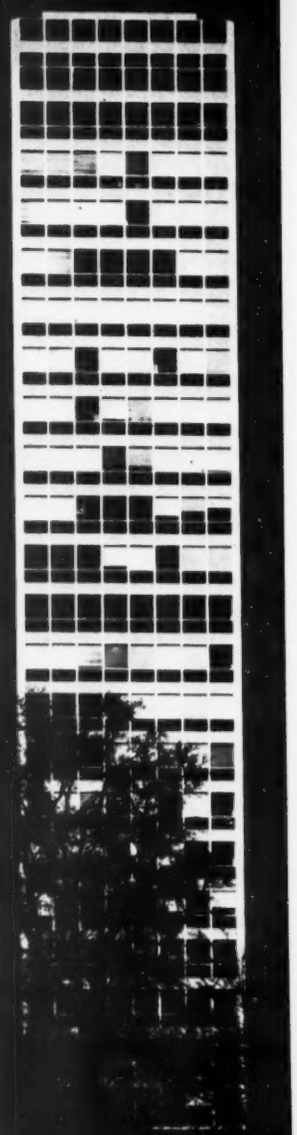
**The Busway Story** *available through National Electrical Manufacturers Assn., 155 E. 44th St., New York 17, N. Y., 1959. Color slide film, running time 15 min. Technical representative will present film on request.*
Busway systems are explained showing many examples.

**Film for Learning** *produced by United States Steel Corp., 71 Broadway, New York 6, N. Y., 16 mm., running time 30 min. Available on loan basis.*
Designed as an aid to school administrators, civic groups and architects in getting new schools approved, planned and built.

**Building for Safety** *produced by Underwriters' Laboratories, Inc., 161 Sixth Ave., New York 13, N. Y., 1959. Color, sound, 16 mm., running time 13½ min. Available on loan basis.*
Describes how Underwriters' Laboratories tests materials and structures under scientifically controlled fire.

## MECHANICAL FINISHES FOR ARCHITECTURAL ALUMINUM

*A table of standard mechanical finishes for architectural aluminum as provided by the National Association of Architectural Metal Manufacturers. Tentative NAAMM designations are provided (at right of page) pending recommended designations by the Aluminum Association. Data concerning proprietary finish designations was not available from other suppliers at the time of the publication of the NAAMM tentative reference standards.*



### PROPRIETARY DESIGNATIONS

| ALCOA | KAISER | OLIN | REYNOLDS | TENTATIVE NAAMM DESIGNATION | DEFINITION OF FINISH |
|---|---|---|---|---|---|
| as fab | NF | NF | XX0X | NA-0 | As fabricated. |
| no symbol | M1 | M1 | no symbol | NA-1 | Polished with aluminum oxide compound. Grits to be coarser than 320; final polishing with a 320 grit, using peripheral wheel speed 6000 fpm. |
| A1 | M2 | M2 | XX2X | NA-2 | Polished with aluminum oxide compound. Grits to be coarser than 320; final polishing with a 320 grit. using peripheral wheel speed of 6000 fpm. Polishing followed by buffing, using aluminum oxide buffing compound and peripheral wheel speed of 7000 fpm. |
| E | M3 | M3 | XX3X | NA-3 | Coarse satin finish producing a surface with parallel scratch lines. Grit used to be a 120 to 140 aluminum oxide type; peripheral wheel speed of 6000 fpm. |
| D | M4 | M4 | XX5X | NA-4 | Medium satin finish producing a surface with parallel scratch lines. Grit to be used to be a 140 to 180 aluminum oxide type; peripheral wheel speed 6000 fpm. |
| C1 | M5 | M5 | XX5X | NA-5 | Fine satin finish producing a surface with parallel scratch lines. Grit to be used to be a 180 to 220 aluminum oxide type; peripheral wheel speed of 6000 fpm. |
| C2 | M6 | M6 | no symbol | NA-6 | Hand-rubbed finish, using stainless steel wool lubricated with neutral soap solution. Final rubbing with #0 steel wool. |
| K | M7 | M7 | no symbol | NA-7 | Wire wheel brush finish, using stainless steel wire brush. Wire diameter .0095"; peripheral wheel speed 6000 fpm. |
| C3 | M8 | M8 | no symbol | NA-8 | Vonnegut wheel finish, using #220 aluminum oxide type abrasive, flat type wheel for flat surfaces, shredded type for uneven surfaces. |
| G4 | M9 | M9 | XX4X | NA-9 | Coarse sand blast finish, using 16 to 20 mesh silica sand if darkening is not a problem; otherwise aluminum oxide type abrasive. Air pressure 30 to 90 pounds (depending on gauge of material); gun distance one foot from work at an angle of 60 to 90 degrees. |
| G3 | M10 | M10 | XX4X | NA-10 | Medium sand blast finish, using 40 to 50 mesh silica sand if darkening is not a problem; otherwise aluminum oxide type abrasive. Air pressure 30 to 90 pounds (depending upon gauge of material); gun distance one foot from work at an angle of 60 to 90 degrees. |
| G2 | M11 | M11 | XX4X | NA-11 | Fine sand blast finish, using 100 to 200 mesh silica sand if darkening is not a problem, otherwise aluminum oxide type abrasive. Air pressure 30 to 90 pounds (depending upon gauge of material); gun distance one foot from work at an angle of 60 to 90 degrees. |
| no symbol | M12 | M12 | no symbol | NA-12 | Shot blast finish, varying in texture with the size of shot and amount of air pressure used. |
| AIR5 | no symbol | no symbol | XX7X | NA13 | Buffed and chemically brightened finish. |
| N | no symbol | no symbol | no symbol | NA-14 | A uniform, matte surface created by loose sand, gravel, steel balls used in an agitating process. Suited for castings and flat sheet. |

### COMBINED FINISHES

To designate combination finishes, the designation consists simply of a combination of the symbols indentifying the various component finishes. As an example, the NAAMM designation of the equivalent of Alcoa's 215-R1 would NA-CE2A.

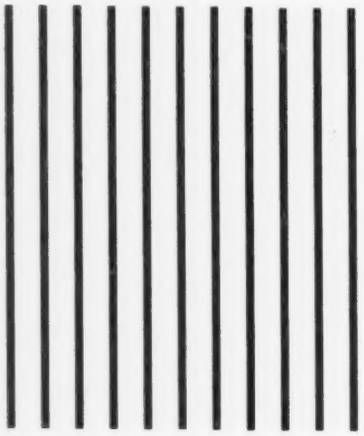
### Standard chemical and electro-chemical finishes for architectural aluminum

| | | | | | |
|---|---|---|---|---|---|
| R1 | C1 | C1 | XX6X | NA-CE | Caustic etch, using solution of sodium hydroxide or sodium hydroxide and sodium chloride. Degree of etch to be controlled by time and strength of solution. |
| R5 | no symbol | no symbol | XX1X | NA-CB | Chemically brightened finish, highly lustrous and bright. |
| 204 | A1 | A1 | no symbol | NA-1A | Clear anodized finish having a minimum coating thickness of .0004" and minimum coating weight of 17 mg. per square inch. |
| 215 | A2 | A2 | no symbol | NA-2A | Clear anodized finish having a minimum coating thickness of .0008" and a minimum coating weight of 35 mg. per square inch. |

### COMBINED FINISHES

To designate combination finishes, the designation consists simply of a combination of the symbols identifying the various component finishes. As an example, the NAAMM designation of the equivalent of Alcoa's 215-R1 would be NA-CE2A.

# STAINLESS STEEL PROPERTIES



*A discussion of the structural properties of stainless steel is provided in the special study of stainless steel curtain walls prepared by the School of Architecture at Princeton University for the Committee of Stainless Steel Producers of the American Iron and Steel Institute*

## Types of structural properties

Stainless steel is the generic name for a large family of alloys which are remarkably resistant to corrosion. The two main groups are the chromium-nickel alloys (300 series) and the chromium alloys (400 series).

The chromium-nickel alloys are the best known and the most corrosion resistant. They are characterized by very high strengths, and retain a remarkable amount of strength at high temperatures. The chromium-nickel alloys have a higher coefficient of thermal expansion than carbon steel.

Type 302 (17-19 per cent chromium, 8-10 per cent nickel) is the general purpose stainless steel and the one most often used, especially for outdoor applications on buildings. Type 316 (16-18 per cent chromium, 10-14 per cent nickel, 2-3 percent molybdenum) is the most corrosion-resistant alloy for exposure to salt water spray.

The chromium alloys also have high strength. Although somewhat less corrosion-resistant than nickel-bearing steels, they have proven to be satisfactory for building use except along the seacoast. They have a lower coefficient of expansion than carbon steel. They are generally lower in price than the nickel-bearing alloys. Type 430 (14-18 per cent chromium) is the chromium stainless steel most used in building work.

**Recommendation:**

In general, use Type 302.

Consider Type 430 for maximum economy, where conditions will permit.

The nickel-bearing stainless steels differ from carbon steel and some other metals in having no clearly defined yield point. The stress-strain curve is smooth and the transition from elastic to plastic deformation is gradual. The yield point has been arbitrarily taken as the point at which the curve intersects a straight line parallel to the lower (straight) part of the curve and .2 per cent offset from it.

Stainless steel facing material is available from the mill in coil stock or in cut sheets. (Stainless steels are also supplied in bar, wire, tube and light structural shapes.) Maximum widths available vary with the gauge: the thinner the gauge, the narrower the sheet. Since sheet width is often a critical factor in curtain wall design, careful note should be taken of the following table of maximum widths for each gauge:

| | | |
|---|---|---|
| gage 14 | (.078") | 72" wide |
| gage 16 | (.063") | 72" wide |
| gage 18 | (.050") | 72" wide |
| gage 20 | (.038") | 72" wide |
| gage 22 | (.031") | 66" wide |
| gage 24 | (.025") | 60" wide |
| gage 26 | (.019") | 49" wide |
| gage 28 | (.016") | 48" wide |
| gage 30 | (.013") | 38" wide |
| gage 32 | (.010") | 36" wide |

Stainless steel sheet can be roll formed, pressed, bent, sheared, welded and soldered. Tooling costs for rolls and dies are considerable and these processes are economical only for mass-production. For a single building, or a group of buildings, brake-forming is usually the most economical fabricating method. All types of welding can be done on stainless steel. A welded joint can develop the full strength of the joined material and be fully corrosion resistant. Welds can be ground down and the adjacent area finished to make a joint between polished sheets invisible.

## Finishes

The standard finishes of stainless steel sheet for use in building are as follows:

No. 2D (Dull cold rolled.) Suitable where a nonreflective effect is desired.

No. 2B (Bright cold rolled.) Somewhat brighter than 2D, but not as high a luster as a polished finish. These two finishes are usually used for curtain wall construction.

No. 4 Polished—This is the finish most used for architectural trim. It can be matched in blending welds and covering fabrication markings. It is bright but not extremely reflective.

No. 6 Polished tampico brushed—This is a number 4 finish brushed with tampico fiber. The finish is conservative, soft and of low reflectivity.

Finishes No. 2D, and 2B are standard cold rolled finishes at no extra cost. No. 4 finish costs, depending on gage, from 13 to 40 per cent more than the rolled finishes and No. 6 finish costs from 20 to 59 per cent more. No. 4 and No. 6 finishes can be obtained from the mill or can be done by the fabricator. They are the finishes most used by architects, whether for monumental building entrances or for restaurant kitchens. However, for curtain walls to cover an entire facade of a building these luxury finishes are unnecessary and, in the case of the No. 4 finish, may be undesirable because of high reflectivity. The 2D and 2B finishes are generally satisfactory for curtain wall use. Some producers also offer a special 2D finish which is extra dull.

Much of the attractiveness of stainless steel, like silver, lies in its metallic brightness. However, the bright finishes, No. 2B and No. 4, are also highly reflective and this is not always desirable for the wall of a building. If the building is not regularly cleaned, the accumulation of dirt, may, in the course of a few years, considerably dull the brightness and eliminate most of the reflectivity. The duller finishes, No. 2D and No. 6, diffuse light and do not reflect images, but do have considerable metallic luster, and are satisfactory for building work. Accumulated dirt tends to conceal this luster and in time the surface may even lose its metallic character entirely. If the building is not to be cleaned regularly, the architect must choose between the finish which will give the best appearance when new and the finish which will look best after, say, ten years.

Besides specular reflection, the No. 4 finish exhibits a remarkable property of reflecting any light source, regardless of its shape, as a brilliant straight line. The effect is exactly as though a cold-cathode tube were being seen reflected in the polished surface of the steel. The bright line is always perpendicular to the direction of the polishing, regardless of the position of the sheet or the angle of incidence. It may appear on a building as a horizontal or vertical line, depending upon which way the sheet is installed. This bright line accentuates any deviation from flatness. In a city building surrounded by street lights, red and green traffic lights, moving automobile headlights and lighted signs of various colors, this reflective effect can be very disturbing.

The 2B finish has a similar reflective property, but to a much lesser degree. In this case the light source, regardless of its shape, is reflected as a bright round spot with a thin straight line running through it. The direction of the line is perpendicular to the direction rolling. The duller finishes, No. 2D and No. 6, do not exhibit this property. The effect is apparently a property of the direction of rolling and polishing.

So far as is known, dirt accumulation is a property of the smoothness of the surface. Generally speaking, on a smooth vertical surface little dirt can collect and what does is easily washed off by the rain. For minimum dirt collection, smooth flat panels are desirable, with flush joints and no projecting horizontal members. It should be remembered, however, that smooth flat panels may collect less dirt but show it more. Any streaking or other irregular form of dirt-straining can be very disfiguring to a plain flat panel. Textured sheets will naturally tend to collect dirt, but the dirt accumulations will probably accentuate the pattern and thus be less likely to be objectionable in appearance.

Since there is a dearth of factual material on the dirt accumulating

characteristics of various finishes and various materials, it is planned to investigate this subject.

Protective coatings are often applied by the fabricator to stainless steel panels and trim, especially those with polished or brushed finishes. These coatings are sometimes left on during the construction of the building and removed as part of the final clean-up. Commonly used protective coatings are paper, waxes or plastic sprays. There have been cases where the protective coatings proved to be very difficult to remove, and other cases where the removed coating left an invisible residue which caught dirt and held it tenaciously.

Stainless steel curtain wall panels do not normally employ polished finishes and it may be that they do not require any protective coating at all, provided they are given a thorough cleaning after completion of construction, as is done to glass.

The use of metal and glass for the walls of buildings is bringing about a basic change in the attitude of the public toward the "weathering" and cleaning of buildings. These sleek new materials, unlike masonry, lose much of their beauty when they get dirty.

"Weathered charm" and similar phrases from the architecture of the past, do not seem to apply to these materials which look their best when new, and grow less attractive as they get dirty. This has been long recognized in the case of glass and it is accepted practice to clean windows frequently. When glass began to be used for curtain walls as well as windows, the customary regular cleaning was extended to the walls. Several buildings with metal walls have now adopted this practice. These are air-conditioned buildings with all windows fixed. In some buildings the entire facade, wall and window alike, is cleaned from a permanent mechanically operated scaffold suspended from the roof. This practice can be expected to increase. The final step, no doubt, will be the development of a fully automatic apparatus to do the job.

**Recommendation:**

Use 2D finish for flat sheets.
Use 2B finish for embossed sheets.

**Texture**

A wide range of textures is available to the designer of stainless steel curtain walls. Textured sheets are rolled with patterns ranging in depth from .005" to 1½" and in pattern width from approximately ⅛" to 8". Patterns are of two general types—all over and one-directional. Most patterns are regular and geometrical, but some are irregular or random. A wide variety of patterns is available in sheets up to 36" wide. The shallower patterns are usually called "embossed" and the somewhat deeper patterns are often referred to as "rigidized," although it should be noted that this is a trade name. "Textured" has been used in this report to designate both types.

The deeper all-over patterns present something of a problem at the joints, particularly the vertical ones, which are difficult to make tight. One solution is to have the pattern stop short of the edges of the sheet, which remain flat and can be formed as desired. Or the edges of the textured sheet can be re-flattened and then formed.

The one-directional patterns are generally referred to as "ribbed" or "fluted." Sections through the ribs may be rectangular, V-shaped or curved. These patterns are very widely used almost always in a vertical position. When so used they present few joint problems; the sides of the sheet can be readily formed into interlocking joints or can be lapped, and the ends can be telescoped or covered where necessary with flashing-type members.

Ribbed sheets are used most often for rigidity, sometimes to break up reflections, and sometimes to conceal unevenness and other minor defects in the wall. Aesthetic considerations are often distinctly secondary, although few things have so important an influence on the final appearance of the building as the texture of the wall panels. By his selection of texture the architect not only gives visual interest and character to the wall but more important, he gives scale to the building as a whole. Textures of still larger scale than those described above can be obtained by the use of alternating panels of different depth or pattern. For a particularly important building the architect may prefer to design a special pattern to be die-stamped in the sheet. This may be an expensive process not applicable for general use, but it does give the architect complete control of the texture and scale of the building wall.

**TABULAR MATERIAL supplied through the courtesy of the committee of Stainless Steel Producers of the American Iron and Steel Institute. Original source is the study, "Curtain Walls of Stainless Steel," prepared for the Committee of Stainless Steel Producers by the School of Architecture, Princeton University.**

## CORE AND INSULATION MATERIALS

| Material | Weight[1] Pounds | Available Thickness | Available Sizes | Conductivity Btu per inch | Moisture Resistance | Fire Resistance | Thermal Expansion | Cost[1] | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Gypsum board | 5.23 | ½" to 2" | 4'x 8', 10', 12' | 1.41 | Poor | Incombustible | | 12¢ | |
| Asbestos-cement with fiberboard core | 3.75 | 1¼" to 2" | 4'x 6', 8', 9', 10', 12' | .40 | Fair (expands) | Incombustible | Negligible | 40¢ | |
| Marinite (calcium silicate) | 3.00 | ½" to 2" | 4'x 8', 10', 12' | .75 | Poor | Excellent | Negligible | High | |
| Cemented excelsior | 2.3 | 2" to 3" | 32" wide | .45 | Fair (expands) | Incombustible | Negligible | 2" thick—12.5¢ 3" thick—11.0¢ | |
| Foamglas | .75 | 2" to 5" | 12"x 18" | .39 | Excellent | Incombustible | Negligible | 13¢ | Vapor proof |
| Paper honeycomb with perlite fill | .7 | | | .39 | Fair | Poor | Negligible | 16¢ | |
| Cork board | .6 | 1" to 6" | 12"x 36" to 36" by 36" | .26 | Fair | Fire retardant | Negligible | | |
| Fiberglas P-F 615 | .47 | 1" to 4" | 24"x 48" | .24 | Good | Incombustible | Negilgible | 6.5¢ | Batts resist fire to 450° Fibers resist fire to 1000° |
| Aluminum honeycomb | .4 | | | | Excellent | Incombustible | High | 80¢ | |
| Paper honeycomb | .3 | to 4" | | .58 | Fair | Poor | Negligible | 12¢ | |
| Mineral wool | .25 | | | .27 | Fair | Excellent | Negligible | 2¢ | |
| Polystyrene foam | .16 | | | .27 | Fair | Self-extinguishing | Negligible | | |
| Pumice concrete | 8.0 | | | 2.42 | Poor | Excellent | Small | | |
| Perlite concrete | 2.6 | | | .77 | Poor | Excellent | Small | | 1 to 5 mix. Shrinks considerably in curing |
| Foam concrete | 2.5 | | | .6 | Good | Excellent | Small | 10¢ | including material & labor |
| Vermiculite concrete | 2.25 | | | .76 | Poor | Excellent | Small | | 1 to 6 mix. Shrinks considerably in curing |
| Sprayed Asbestos | .9 | ½" to 2" | | .26 | Good | Excellent | | | |

[1]per square foot 1" thick; costs are approximate

## TYPICAL PROPERTIES OF WALL FACING MATERIALS.

| Material | Chemical Composition Per Cent | Melting Range °F | Density lb/cu ft | Mean Coef. of Thermal Expansion In/In/°Fx10⁻⁶ (32-212°F) | Yield Strength psi (Annealed) | Ultimate Strength psi (Annealed) | Elongation % In 2" | Modulus of Elasticity psi x 10⁶ |
|---|---|---|---|---|---|---|---|---|
| Stainless Steel Type 301 | Cr 16.0-18.0 Ni 6.0- 8.0 | 2550-2590 | 501 | 9.4 | 40,000 | 110,000 | 60 | 28.0 |
| Stainless Steel Type 302 | Cr 17.0-19.0 Ni 8.0-10.0 | 2550-2590 | 501 | 9.6 | 40,000 | 90,000 | 50 | 28.0 |
| Stainless Steel Type 316 | Cr 16.0-18.0 Ni 10.0-14.0 Mo 2.0- 3.0 | 2500-2550 | 501 | 8.9 | 40,000 | 90,000 | 50 | 28.0 |
| Stainless Steel Type 430 | Cr 14.0-18.0 | 2600-2750 | 484 | 5.8 | 45,000 | 75,000 | 25 | 29 0 |
| Stainless Steel Type 442 | Cr 18.0-23.0 | 2600-2750 | 484 | 5.7 | 45,000 | 80,000 | 25 | 29.0 |
| Carbon Steel (Enameling Iron) | | 2700-2750 | 490 | 6.5 | 27,000 | 42,000 | 35 | 29.0 |
| Aluminum 6063 (63S) | Al 99.0 Mn 0.7 Si 0.4 | 1177-1211 | 169 | 13.0 | 13,000 | 22,000 | 20 | 10.0 |
| Aluminum 3003 (3S) | Al 98.0 Mn 1.25 | 1190-1210 | 171 | 13.0 | 6,000 | 16,000 | 30 | 10.0 |
| Copper | Cu 99.9+ | 1980 | 560 | 9.8 | 10,000 | 32,000 | 45 | 17.5 |
| Glass (Plate) | | 1100-2600 | 157 | 5.0 | | 10,000 | | 10.0 |
| Asbestos Cement Board | | | 95-100 | 5.0 | | 4,500 | | 2.0 |

## FORECAST

(*Continued from page 43*)

or sealing compounds are supplied in various consistencies depending on end use and requirements regarding slump resistance, etc. The type of application equipment, whether hand gun or heavy duty pump and flow gun, has much to do in determining the working properties of these materials. These gun grade materials fall into two main classes; the semi-drying material which skins over but remains flexible over an extended period of time, and the non-oxidizing, non-curing material which will remain pliable and adhesive indefinitely. The skinning or semi-drying materials are made up of blends of polybutenes or polyisobutylenes with drying oils such as linseed or soya. The non-skinning, non-curing materials are compounded from vehicles consisting of polybutenes or blends of polybutenes and polyisobutylenes. These materials are used as bedding compounds in installation of insulating glass in windows and in joints where generally there is negligible movement.

"The preformed beads or ribbons are supplied in rolls on a release backing or in flat pack cartons as a general rule. In some instances, there are other forms of packaging. These materials are all non-drying, non-oxidizing, and non-curing and are available in various sizes and shapes which may be readily used by hand-placing them in the desired position. These materials are non-slumping and will remain in place over a wide range of temperatures. The polybutene base preformed type sealers can easily be formed by hand into other desired shapes or may be deformed readily to seal joints of wide tolerance. The polyisobutylene base sealers and compounds are tough and rubbery and are of a more cohesive character than the polybutene materials and cannot be deformed, as readily as the polybutene compounds. The adhesion and flexibility of these materials can sometimes be enhanced by the use of small amounts of polybutenes.

"The preformed reinforced beads and ribbons are essentially the same in composition as the previously mentioned preformed beads and ribbons, but are reinforced by inserts of various types to give them special properties and to improve their performance as sealers under certain conditions. These inserts, which include various types of cloth, cords, and rubbers, enable these compounds to conform to different or special sealing applications and function properly as a sealer. Proper inserts in these sealers can overcome the possibility of their being squeezed out of the joint or of their being compressed beyond their ability to recover.

"*Limitations:* Like all known sealers today, polybutene and polyisobutylene

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## JOINT DETAILS

*Every joint between panels or wall units is potentially a weak point which would permit the eventual penetration of water and air. A good joint design must achieve:*

1. *Prevention of air and water leakage*
2. *Flexibility*
   a. *for large tolerances in building construction*
   b. *for expansion and contraction due to temperature changes*
   c. *for removal*
3. *Control of moisture*
   a. *by drainage*
   b. *by ventilation*
4. *No through-conductivity of metal*

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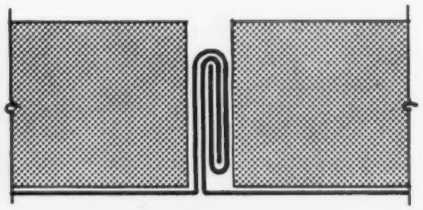
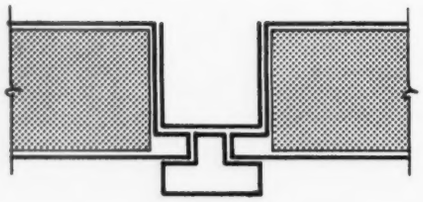
*From* Curtain Walls of Stainless Steel, *a study prepared by the School of Architecture, Princeton University for the Committee of Stainless Steel Producers of the American Iron and Steel Institute.*

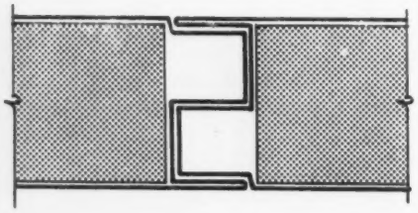
Interlocking joints: these types of joints are used with panels for large expanses of wall such as in warehouses, power stations and other industrial buildings. This type of joint may not always be air tight. Therefore, a compromise is usually sought because of certain factors such as ease of erection, building tolerances, cost and tightness of joint.

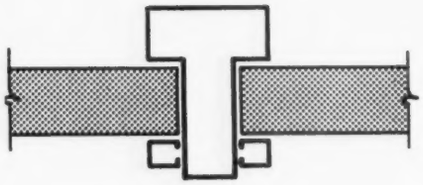


Batten joints: similar to the mullion window-stop type of joint. It has more flexibility in erection and offers a wide variety of possibilities in design. However, it can be one of the most expensive ways of joining materials.

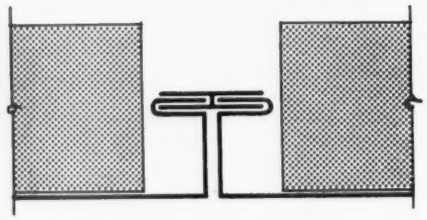


Tongue and groove: A very simple joint for erection which speeds up installation. Its principal disadvantage is the difficulty of the alignment of adjacent panels if a smooth surface is required.





Mullion window-stop: One of the most commonly used joints. It has advantage of being able to be used without a change for materials of various thicknesses. Often it may be assembled from stock sash sections that are already widely in use. It has many parts which require considerable precision in assembly and installation.



Spline joints: One of the oldest forms of joining two pieces of material. It permits flexibility for replacement, removal and expansion. One disadvantage is the concentration of metal at one point which has to be well insulated against thermal "short circuit."

## FORECAST

(*Continued from page 63*)

base products have their limitations. If we are to intelligently select the proper sealer for the job, we must have a knowledge of their limitations as well as their properties. For this reason, let us discuss some of the limitations of these sealing materials.

"The improved drying types of caulking and sealing compounds, even though plasticized and extended with polybutenes, do not have the flexibility which is essential for the satisfactory sealing of all types of joints in curtain wall construction. These materials give good performance in joints in which there is little or no movement due to contraction and expansion of the component parts. The performance of these materials has been proven many times in the sealing of doors and windows.

"The non-drying polybutene base materials maintain surface tack and tend to gather dust and dirt. In laboratory tests, it has been determined that excessive dirt collection can cause hardening and loss of elasticity of the compound eventually resulting in cohesive failure of the sealer. If used in a joint where movement can cause a press effect, the vehicle may be forced out of the non-drying polybutene type sealers.

"The sealers compounded from polyisobutylene or from blends of polyisobutylene and polybutene are, as a rule, superior to those compounded from straight polybutene vehicles. These materials, with the exception of a few gun grade compounds, because of their tough, rubbery, cohesive nature, are limited to application during assembly only. Preformed shapes, if not reinforced, can be compressed beyond their limit to recover and in extreme cases may be squeezed almost entirely out of the joint. Comparable sealing materials, which are compounded from vehicles of uncured butyl rubber or polyvinyl ethyl ether, have the same limitations in general as do polyisobutylene materials which we have been discussing.

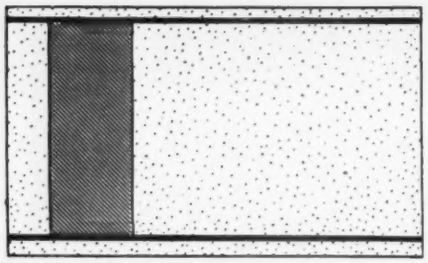
"*Methods of application:* Gun application is possible and is the recommended method of applying gun grade drying type caulking compounds and gun grade plastic sealers of the non-drying, non-oxidizing type. The application equipment may range from a small hand gun to a heavy duty commercial pump and flow gun.

"Knife grade caulks and most grades of polybutene base, non-drying sealers may be applied with a putty knife or glazing tool. The polybutene base materials may be applied as bedding and sealing compounds in factories or assembly plants by the use of extrusion type applicators: Slugs of material are placed into the extruder and the sealer is ex-

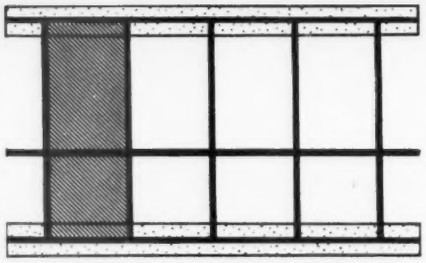
(*Continued on page 67*)

## SYSTEMS OF CURTAIN WALL ATTACHMENT

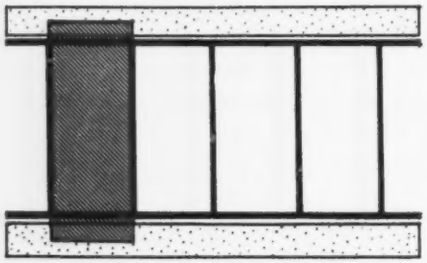
*From* Curtain Walls of Stainless Steel, *a study prepared by the School of Architecture, Princeton University for the Committee of Stainless Steel Producers of the American Iron and Steel Institute.*



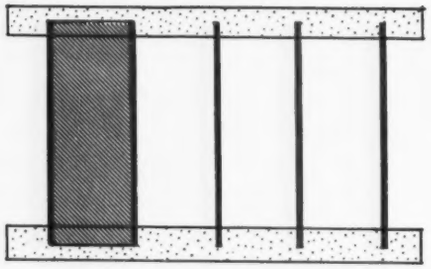
Elevation showing wall unit attached to unbroken surface by use of horizontal girts. This system is often used in remodeled construction.



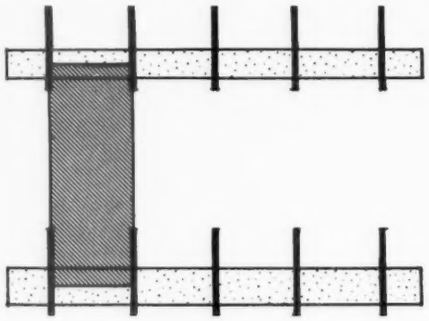
Wall units attached to a grid of vertical mullions and horizontal girts.



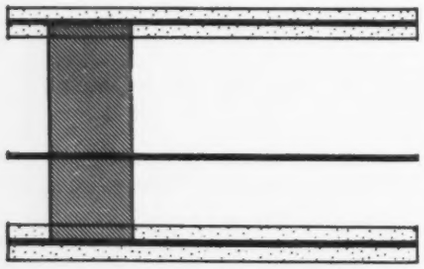
Wall units attached to mullions one story high and to horizontal girts or inserts at floor and ceiling.



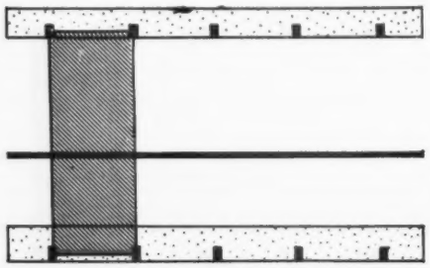
Wall unit attached to mullions of one or two stories in height.



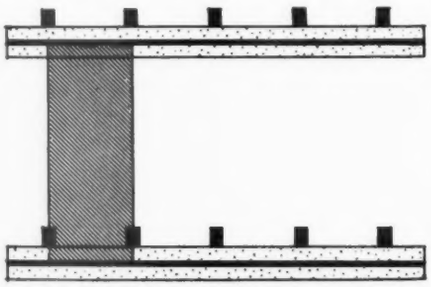
Wall unit attached to spandrel beam using stub mullions. The panel is actually cantilevered from the spandrel.



Wall unit attached to spandrel beam using horizontal girt at sill and horizontal girt or concrete insert in spandrel.



Wall unit attached to spandrel beam by use of plate clips at bottom of beam and a horizontal girt at sill height.



Wall unit attached to spandrel beam using shoe brackets and horizontal girts or concrete inserts.

(*Continued from page 65*)

truded through special shaped dies directly onto the parts prior to assembly.

"The preformed sealers fall into two classes as far as application methods are concerned. The polybutene base materials, as we have previously stated, are easily deformed by hand and thus are easy to apply to most any shape or size joint by simply pressing the sealer into the seam with the fingers. On the other hand, polyisobutylene compounds and compounds composed of blends of polyisobutylene and polybutene are not readily deformed and are supplied preformed in the correct size and shape for the joint.

"*Building design and sealer performance:* The design of a joint can greatly affect the performance of the sealing compounds used. In order to design a properly sealed joint, it is essential that the properties of available sealing materials be known. The movement in the joints becomes more and more important as larger and larger panels and windows are used in the construction of buildings today. These larger panels, due to weather, temperature changes and wind pressures, create multiplied problems for the sealer industry. The statement has been made that buildings literally dance. These sealing materials of which we have been talking are required to seal and bridge the gaps or joints between dancing members. The buildings of today have seven league boots in comparison to the buildings which were erected a few years ago.

"Modern building techniques have created many new sealing problems. We have all seen glass panels sealed or glazed into metal window sash with linseed oil putty that gets almost as hard as the glass. In spite of the lack of elasticity of the linseed oil putty, it *may* maintain a good seal for years. In joints such as this or in similar joints in which minimum movement is found, conventional caulks and polybutene base materials are usually satisfactory. The building methods of today, however, create sealing problems which demand new types of sealing and caulking materials.

"Sealant manufacturers have been faced with many problems due to size variations in seams and joints. Our experience has revealed that structures designed to have seams or joints of a specified size do not necessarily conform to these sizes when the structure is completed. Why? It is possible that not all variables that are present in the materials, panels, and other component parts were studied or considered when the structure was planned. All manufactured parts and panels have tolerances in their specifications. When two or more panels, on the upper limit of the specification, fall next to each other in the building, a

(*Continued on page 68*)

## FORECAST

(*Continued from page 67*)

variation in the size of the joint is the result. Since we have parts both on the plus and on the minus sides of the desired size, we have a wide variation in the size of the seams as a result. As long as people are fabricating and assembling these component parts, we will have this problem.

"The configuration of joints and seams is a most important part of building design. It is not the amount of sealer used, but the type, how and where it is used that is important in securing a good seal. A proper joint design is just as important as a proper sealer design. The designer should consider the proper relationship between the capabilities of the sealing material, the width of the joint, and the amount the joint changes in width. Another important variable worthy of consideration is the depth of the sealer in the joint.

"*Conclusion:* Polybutene and polyisobutylene base materials are satisfactory in many sealing applications and as such, do a good job when properly used. However, these materials in many sealing areas should not be used alone. The satisfactory sealing of some joints and seams calls for two or more types of sealing compounds or one that combines in a single sealant, two or more products, each of which alone provides a degree of weather tightness. A word of warning should be interposed here, since not all sealing compounds can be used together. Before using more than one sealer in a seam, it is well to know how the proposed sealers will react when placed together in a seam.

"It must be remembered that there is no universal sealing material which can be used to give the best performance in every case. The architect and the sealant manufacturer must work together to determine the proper joint design and the correct sealing material for each use."

**Current status of sealants for curtain walls** *by Jack M. Roehm, Director of Research and Development, Kawneer Co., Niles, Mich.*

"The use of metal curtain walls as a means of enclosing a building, has experienced a growth since 1950 which can only be described as explosive. A similar growth has occurred in the technology and techniques required to build these walls. Many of the techniques employed in obtaining a satisfactory curtain wall today were unknown a mere dozen years ago.

"Sensational as the use of metal and glass techniques in curtain wall construction may have been, the use of the materials that hold the metal and glass together and the technology required in

these materials may be said to be even more sensational. It is in the area of the material that holds the glass and metal together, the materials which we commonly refer to as sealants, that the greatest demand has been placed. It is upon these materials that we rely to obtain a wall that fully protects the building occupants from the weather. For many years we have known how to make a pane of glass watertight or an insulated panel watertight, and we have had no troubles in making metals impervious to moisture and weather. We have had troubles, however, with the materials that joined the various components of the metal curtain wall together. After all, no wall can be any better than the materials used to hold the components together.

"A few decades ago, the principal sealant used in any wall construction was putty. Putty is a very simple chemical substance consisting of a mixture of calcium carbonate and boiled linseed oil. It had advantages in that it could easily be mixed and applied on the job site and would perform with some degree of satisfaction over a period of years. As progress was made, however, the word "mastic" crept into the nomenclature of the trade. In checking the meaning of this, I find that mastic is a resin from the Mastic Tree which grows in southern Europe; it has since come to mean any pasty cement. Mastics were relatively simple products and required no significantly new techniques in the way of application, although at this time we did begin to see caulking guns come more and more into the picture as a supplement to the glazier's putty knife. Both putties and mastics have been continuously improved and today are used extensively and successfully in many sealing applications.

"Not so many years ago, the chemist really became interested in this matter. It was at this time that the technology of sealing materials really began to make sensational progress, or at least the technology produced a sensational number of different types of products, all in one way or another supposed to be able to accomplish a job of sealing. The lines of development followed two general paths. One path led to resilient preformed gaskets or sealants, the other path led to materials that more nearly resembled the earlier mastics in the techniques required for application but which possessed the property of curing into rubberlike materials capable of adhering to the surfaces being sealed.

"Du Pont's neoprene, which is a copolymer of chloroprene, was one of the first of the preformed gasket materials to get into the act. As might have been

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# GLOSSARY OF METAL CURTAIN WALL TERMS

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*Definitions of terms representing generally accepted practice in the curtain wall industry today. Based on material presented in* Metal Curtain Wall Manual, *June 1959, published by the National Association of Architectural Metal Manufacturers, 228 North LaSalle St., Chicago 1, Ill.*

**Alclad**—An aluminum product clad with an aluminum alloy coating which is anodic to the alloy it covers, protecting it both physically and electrolytically against corrosion.

**Anchor**—Any device used to secure the metal curtain wall or its parts to the building frame. Anchors should generally be adjustable in three dimensions.

**Anneal**—To heat above the critical or recrystallization temperature, then cool, metal, glass or other materials to eliminate the effects of cold-working, relieve internal stresses or improve electrical, magnetic or other properties.

**Anodic coating**—The surface finish resulting from anodizing. See *Anodize.*

**Anodize**—To provide a hard non-corrosive oxide film on the surface of a metal, particularly aluminum, by electrolytic action. The electrochemical process produces an anodic coating by conversion of aluminum into essentially aluminum oxide. Appearance depends upon both the alloy involved and the surface preparation. Anodic coatings may be transparent, of varying shades of silver, gray or brown, or colors may be incorporated by the uses of dyes or pigments.

**Arc welding**—A process for the joining of metal parts by fusion, in which the necessary heat is produced by means of an electric arc struck between an electrode and the metal or between two electrodes.

**Back putty**—The bedding of glazing compound which is placed between the indoor face of glass and the frame or sash containing it.

**Baffle**—A deflecting surface within a metal wall member, so located as to control or prevent the penetration of air or water into or through the wall. Commonly used in conjunction with weepholes or slip joints.

**Bead**—(a) A strip of metal or wood used around the periphery of a pane of glass to secure it in a frame or sash (also referred to as a *stop*). (b) A strip of sealant, such as caulking or glazing compound.

**Bed glazing**—Same as *back putty.*

**Bench mark**—A datum point of known elevation, which serves as a reference in establishing other levels or locations.

**Bonderite**—A surface treatment for aluminum. See *bonderizing.*

**Bonderizing**—A treatment for iron and steel in which the surface is converted into an insoluble phosphate. It has little corrosion resistance in itself, but provides an excellent base for paint. *Bonderite* coatings as a paint base for aluminum are also available.

**Brinell hardness**—A measure of resistance to indentation, determined by measuring the area of indentation produced by a hard steel ball under standard conditions of loading.

**Burr**—A rough or sharp edge left on metal by a cutting tool.

**Carburize**—To produce a hard surface layer on steel by heating in a carbonaceous medium to increase the carbon content, then quenching. The process is also referred to as *case-hardening.*

**Caulk**—To fill joints, cracks or crevices in order to make them watertight.

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**Caulking cartridge**—An expendable container made of plastic, fiberboard, or metal, filled with caulking compound, for use in a caulking gun. A common type is 2" in diameter, 8½" long, and is fitted with a plastic nozzle.

**Caulking compound**—A soft putty-like material intended for sealing joints in buildings and other structures, where leakage or structural movement may occur. It is usually available in two consistencies; *gun grade,* for use with a caulking gun and *knife grade,* for application with a putty knife.

**Caulking gun**—A device for applying caulking compound by extrusion. In a hand gun the necessary pressure is supplied mechanically by hand; in a pressure gun the pressure is usually greater, and is supplied pneumatically.

**Caustic etch**—A decorative matte texture produced on aluminum alloys by an etching treatment in an alkaline solution, generally caustic soda (sodium hydroxide). Also known as *frosted finish.*

**Clearance**—The space or distance allowed for anchorage or erection processes or to accommodate dimensional variations in the building structure.

**Clip**—(a) A small device, usually of metal, for holding larger parts in place, either by friction or by mechanical action. (b) In glazing, a spring device of metal used to hold glass in a metal sash.

**Cold welding**—A method of joining metals such as aluminum, by subjecting the thoroughly cleaned joining surfaces to pressure in specially shaped dies. When the combined thicknesses of the surfaces are reduced by a specific percentage, a weld occurs at normal temperatures.

**Corrosion**—The deterioration of metal by chemical or electrochemical reaction resulting from exposure to weathering, moisture, chemicals or other agents or media.

**Creep**—The permanent deformation of a material at a given temperature under sufficiently high sustained loading, continuing with time but without increasing the load.

**Curtain wall, metal**—An exterior building wall which carries no roof or floor loads, and which may consist principally of metal or of a combination of metal, glass and other surfacing materials supported in a metal framework. There are three basic types: (1) *Custom:* walls designed specifically for one project, and using parts and details specially made for this purpose. (2) *Commercial:* walls made up principally of parts and details standardized by the manufacturer and assembled either in the manufacturer's stock patterns or in accord with the architect's design. (3) *Industrial:* walls in which ribbed, fluted or otherwise preformed metal sheets in stock sizes are used, along with standard metal sash, as the principal elements.

**Deflectometer**—A device for measuring the amount of bending induced in a beam by transverse loading.

**Dew point**—The temperature at which the condensation of water vapor in a space begins, at a given state of humidity and pressure, as the temperature of the vapor is reduced.

**Double glazing**—In general, any use of two thicknesses of glass within an opening, in place of one, to improve insulation against heat transfer and/or sound transmission. In factory-made double glazed units, the air between the glass sheets is thoroughly dried and the space is sealed airtight, eliminating possible condensation and providing superior insulating properties.

**Durometer**—An instrument for measuring the relative hardness of materials such as rubber. Also, the term often used (loosely) as a synonym for relative hardness. Durometers are of several proprietary types, one of the most common being the Shore, Type "A." On the scale of this instrument, which is graduated from 0 (softest) to 100 (hardest), a faucet washer or rubber flooring has a value of 90, plus or minus 5, and a stationer's rubber band a value of 40, plus or minus 5.

**Dust-free time**—The time required for a freshly-applied paint or compound to form a sufficiently dry surface skin so that dust will not adhere to it. Also known as *tack-free time.*

**Edge clearance**—The distance between the edge in the plane of the pane or panel.

**Embossed**—Having a raised and/or indented pattern impressed on either one or both surfaces (of a sheet material). Usually accomplished by the use of patterned rolls.

**Erector**—The party who installs the metal curtain wall on a building.

**Extrusion**—The process of producing metal shapes of a constant cross section by forcing the

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## FORECAST

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expected, its initial acceptance as a sealant, wherein the joinery of glass and metal was involved, occurred not in the building field but in the transportation field where it was used very successfully as a sealant in railroad car windows, truck windshields, automobile windshields, and similar applications. Somewhat later polyvinyl chlorides came into the picture and because they had certain features that appeared to be desirable they were employed as a gasket or sealant between glass and metal. More recently we hear of the butyl rubbers which apparently have certain distinct advantages of their own.

"As we have seen we have a variety of materials and a variety of methods for achieving the sealing of a building structure. We come to the designer, however, who must design a building which has certain appearance features, which has certain performance requirements, and which must be built at a cost. Imagine his problem then when he wades through the mass of chemical data, physical data, weathering data and other data available on these different materials. His confusion must be tremendous. He is forced to depend to a large degree on information supplied to him by wall fabricators and by manufacturers of the basic sealant materials. However, in the large architectural firms at least, we have very competent people who are called specification writers. In such offices the designer has the happy situation of being able to pass on to the specification writer the job of spelling out the types of materials to use to achieve the type of wall desired. The specification writer must then prepare a document. . . .

"Fortunately for the industry, a close working relationship has been developed between architectural offices, their specification writers, and the fabricators of metal curtain walls. By an exchange of information among all parties concerned, satisfactory results can be expected when the prescribed procedures are observed.

"Having designed the wall, prepared specifications, fabricated and successfully tested the mockup, the next step, and the major step, is to erect a wall on the basic building structure. If preformed gaskets have been specified, one type of erection procedure will be followed. If the mastics or the cure-in-place glazing compounds have been specified, another procedure will be followed. In either case, close inspection and careful workmanship will be required to assure satisfactory performance once the wall's in place.

"No product can be considered acceptable until it is finally in use and the same is true of the metal curtain wall. In spite of all precautions, some walls when fi-

nally erected will have a leak here and there and the erector will be required to go back and rectify the situation. Fortunately the technology of metal curtain walls has advanced sufficiently today that when leaks do occur, provided the wall has been well designed, they are usually of a minor nature and readily correctable. As a matter of fact, the matter of properly sealing a building has almost become a profession in itself, and at least one firm that I know of engages in nothing but the sealing of walls.

"It is apparent that the situation with regard to specifications for metal curtain walls and particularly the specifications of sealants, has been in a somewhat mixed up state. I am happy to report that very positive steps are being taken by the industry to correct this present, confused situation. The Metal Curtain Wall Division of the National Assn. of Architectural Metal Manufacturers is currently preparing a Metal Curtain Wall Manual [*now available*]. This manual will contain a section on general specifications and recommended performance standards for curtain walls, including standards for materials. I believe we can say that for the first time we will have available an organized body of data on sealant materials and a set of standards for these sealant materials which will permit an architect or specification writer to know ahead of time what he may expect from certain types of materials and also to know how to test these materials to be sure that a manufacturer's product conforms with specifications. This likewise will be a big help to the fabricators and erectors of metal curtain walls. This body of data on sealants has been prepared by a group of leading manufacturers who have worked closely with the fabricators. . . .

"In summary, we have come a long way from the days when putty was the principal means for sealing glass and metal in the building wall. Many new chemical compounds have entered the picture providing superior sealing qualities and giving architects an opportunity to be far more flexible in their designs. In fact, the advance has been so rapid that we are now beginning to build buildings in which the resilient preformed gasketing acts as a structural member in the wall, literally supporting the panes of glass and the panels. Who knows where all of this may lead us in our metal curtain wall designs of the future. We are no longer limited to the plain black of neoprene or the plain gray of vinyls. We have materials available today which permit us to put color in our outside gasketing strips where the architectural treatment calls for it. . . ."

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hot metal through an orifice in a die by means of a pressure ram. Also, any item made by this process.

**Fabricator**—The manufacturer who makes the curtain wall or any of its components.

**Face clearance**—The distance between the outer face of a sheet material such as glass, and the inner face of its retaining frame or stop, as measured normal to the plane of the sheet. This dimension is also the thickness of the sealing material outside the sheet.

**Face glazing**—A method of glazing which employs no loose stops. The glass is set in an L-shaped or rabbeted frame and the glazing compound is finished off in the form of a triangular bead.

**Flush glazing**—A method of glazing wherein the surfaces of the glass retaining members (stops or beads) are in the same plane normal to the glass as the side faces of the frame members; often achieved by providing pockets in these faces.

**Galvanic action or galvanic corrosion**—The electrochemical action which takes place when dissimilar metals are in contact in the presence of an electrolyte, causing corrosion. The extent of corrosion will depend both on the difference in potential between the metals involved and the relative areas of the metal parts.

**Gassing**—The addition of a small amount of unleaded gasoline to oil-base glazing compound, to soften its consistency.

**Glazing compound**—A soft dough-like material used for filling and sealing the space between a pane of glass and its surrounding frame.

**Glue line**—A plane in which glue or adhesive occurs, in a glued or laminated assembly.

**Gun grade or gun consistency**—Of suitable degree of softness for proper application by a caulking gun (referring to caulking or glazing compound).

**Inclusion**—Presence of foreign matter in a finished material.

**Initial set**—In reference to a mastic compound, adhesive or coating, the stage in drying when the surface has become sufficiently firm to be unmarked when touched with the finger.

**Knife grade or knife consistency**—Of suitable degree of firmness for proper application by means of a putty knife (referring to caulking or glazing compound).

**Laminate**—A product made by bonding together two or more layers of material or materials.

**Mastic**—A general descriptive term referring to any heavy-bodied dough-like compound.

**Metallize**—To apply a coating of metal on a base material, usually by spraying the coating metal in a molten state.

**Mock-up**—A model of a section of a wall or its parts, built to scale or at full size, for purposes of studying its construction details, judging its appearance and/or testing its performance.

**Moisture migration**—The passage of moisture into or through a material or construction, in the form of water vapor, due to a difference in vapor pressure at the two faces.

**Mullion**—A vertical framing member in a wall, separating and usually supporting adjacent windows, glass areas, panels or doors.

**Muntin**—A bar member supporting and separating panes of glass within a sash or door.

**Neoprene**—A synthetic rubber made by polymerizing chloroprene.

**Oil-canning**—A slight buckling in sheet metal, causing the appearance of waviness or unevenness.

**Oxygen starvation**—Localized corrosion of metals, in the presence of an electrolyte, due to a smothering of "poultice" action or resulting from a crevice between the metal and another material.

**Panel**—A term used loosely to denote: (a) a solid filler or facing material, either of one piece or an assembly, for use within a surrounding frame (e.g. a spandrel panel on a wall); (b) a pre-assembled section of wall, including framing (if any), window area and solid area; and (c) a length of formed metal sheet, or an assembly of such sheets, usually with insulation between, as used for wall enclosure on industrial type buildings. The definition in (a) above is preferred.

**Parkerizing**—A treatment for iron and steel, in which the clean surface is treated with manganese dihydrogen phosphate. Its primary value is to improve the bonding of paints and lacquers,

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# digest:

but it also provides a durable finish which minimizes corrosion due to porosity or imperfections in the paint film.

**Passivation**—See *pickling*.

**Perm**—The unit of measure of the rate of water vapor transmission through a material, expressed in grains per (square foot) (hour) (inches of mercury pressure difference).

**Pickling**—The treatment of stainless steel surfaces with a strong oxidizing agent such as nitric acid, to make them chemically clean and provide a strong inert oxide film, increasing corrosion resistance.

**Pot life**—The period of time during which a sealant, adhesive or coating, after being mixed with a catalyst, solvent or other compounding ingredient, remains suitable for use. Also referred to as *work life*.

**Organic coating**—A coating such as paint, lacquer, enamel or plastic film in which the principal ingredients are derived from animal or vegetable matter or from some compound of carbon (which includes all plastics).

**Reglet**—A groove cut or formed in masonry or concrete to receive and hold the edge of flashing material.

**Rigidized**—A term generally used in reference to light gauge sheet metal which is embossed or textured by a rolling process. Also the name used by one specific manufacturer of this material.

**Rope caulk**—A pre-formed bead or "rope" or tacky caulking compound, often supplied with twine reinforced to facilitate handling.

**Sandwich panel**—A panel made by laminating a core material, usually of low density, between sheets or "skins" of a material or materials of higher density and strength.

**Sealant**—Any mastic or viscous material used to seal joints or openings against the passage of water or air.

**Setting block**—A small block of neoprene, lead, wood or other suitable material, placed under the lower edge of a sheet of glass when setting it in a frame.

**Shelf life**—The length of time that a packaged material such as adhesives and sealants can be stored under specified temperature conditions and still remain suitable for use.

**Spandrel**—The area of an exterior wall between two superimposed windows or openings.

**Spandrel beam**—A beam in the building frame which extends between exterior columns at a floor level.

**Spandrel panel**—A panel covering the spandrel area; see *spandrel*.

**Starved joint**—An adhesively bonded joint in which the amount of adhesive is insufficient to produce a satisfactory bond.

**Stop**—See *bead*, definition (a). Also, the part of a door frame against which the door closes.

**Stretcher leveling**—The process or flattening metal sheets by stretching them mechanically.

**Tack-free time**—See *dust-free time*.

**Tack weld**—A weld used for temporarily holding metal parts in position.

**Theodolite**—An instrument used for measuring horizontal and vertical angles. Used in curtain wall construction to establish elevations in reference to fixed bench marks.

**Tin-canning**—Same as *oil-canning*.

**Tolerance**—Permissible deviation from a nominal or specified dimension or value.

**Ultimate set**—The final degree of firmness obtained by a plastic compound after cure, evaporation of volatiles or surface polymerization.

**Vapor barrier**—A material or coating sufficiently resistant to vapor transmission to retard the passage of water vapor from zones of high vapor pressure to zones of lower vapor pressure; by usual standards, a material having a permeance of one perm or less, when tested by the ASTM method E-96-53T, Procedures A or C.

**Vinyl**—A thermoplastic compound, specifically a vinyl chloride polymer, with good resistance to weathering. Used for gasketing and coatings, both decorative and protective.

**Weephole**—A small opening in a wall or window member, through which water may drain to the building exterior.

**Window wall**—A metal curtain wall of the commercial type, in which windows are the most prominent element. See *curtain wall, metal*.

**Work life**—Same as *pot life*.

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# calendar

**Oct. 5-30** INTER - AMERICAN HOUSING AND PLANNING CENTER OF THE ORGANIZATION OF AMERICAN STATES: seminar on urban planning, Bogota, Colombia, S. A.

**8-10** NEW YORK STATE ASSN OF ARCHITECTS: annual convention, Whiteface Inn, Lake Placid, N. Y.

**8-10** AMERICAN INST OF ARCHITECTS, northwest regional conference, Spokane, Wash.

**11-16** AMERICAN SOC FOR TESTING MATERIALS: third Pacific area national meeting, San Francisco.

**13** FOURTH ANNUAL ARCHITECT'S TOUR OF JAPAN. Contact Kenneth M. Nishimoto, AIA, 263 South Los Robles Ave., Pasadena, Calif.

**14-16** TEXAS SOC OF ARCHITECTS: annual convention, Austin, Texas.

**19-23** AMERICAN SOC OF CIVIL ENGRS: annual convention, Hotel Statler-Hilton, New York City.

**22-23** ILLINOIS INSTITUTE OF TECHNOLOGY AND ARMOUR RESEARCH FOUNDATION: 15th annual national conference on industrial hydraulics, Hotel Sherman, Chicago, Ill.

**23-24** PENNSYLVANIA SOC OF ARCHITECTS: 14th annual meeting and forum, Galen Hall Hotel, Wernersville, Pa.

**Nov. 1-7** PRESTRESSED CONCRETE INST: fifth annual convention, Deauville Hotel, Miami Beach, Fla.

**2-5** AMERICAN CONCRETE INST: 12th regional meeting, Continental Hilton Hotel and Hotel Del Prado, Mexico City, Mexico.

**2-5** AIR - CONDITIONING AND REFRIGERATION INDUSTRY: 11th exposition, Atlantic City, N. J.

**16-19** BRI: conference, Shoreham Hotel, Washington, D. C.

**Dec. 6-9** AMERICAN INSTITUTE OF CHEMICAL ENGINEERS: meeting, Sheraton Palace, San Francisco, Calif.

**20-30** ARCHITECTURAL INSTITUTE OF JAPAN, KYOTO AND OSAKA: annual convention.

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